

CHEMISTRY

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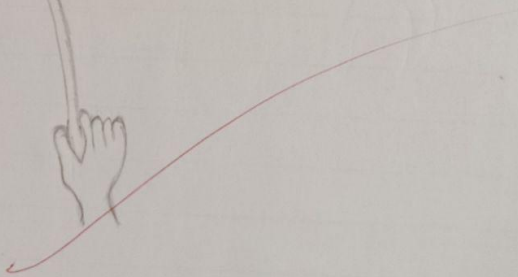
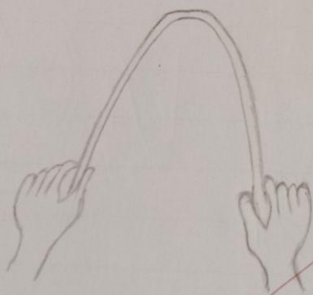
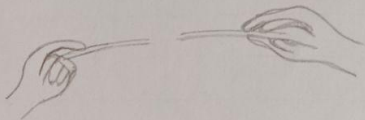
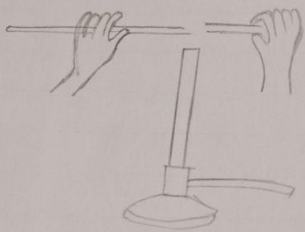
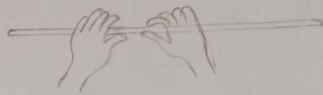
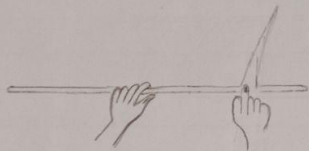
Index

Sr. No	Name of the Experiment	Page No	Date of Experiment	Date of Submission	Remarks
I.	Basic Concepts				
1.	Basic Laboratory Technique	1-3	17/10/22		
2.	Characterisation and Purification of Chemical substances.	4-12	19/10/22		
II.	Quantitative Estimation				
1.	Estimation of NaOH with oxalic acid	14	24/10/22		
2.	Estimation of HCl with Na_2CO_3	15	26/10/22		
3.	Estimation of KMnO_4 with oxalic salt	16	28/10/22		
4.	Estimation of KMnO_4 with Mohr's salt	17	1/11/22		
5.	Estimation of oxalic acid with KMnO_4	18	3/11/22		
6.	Estimation of Mohr's salt with KMnO_4	19	5/11/22		
7.	Estimation of oxalic acid with NaOH	20	11/11/22		
8.	Estimation of Na_2CO_3 with HCl.	21	14/11/22		
III.	Qualitative Analysis.				
1.	Ammonium Sulphate	22-25	16/11/22		
2.	Ammonium carbonate	26-28	18/11/22		
3.	Barium Bromide	29-31	18/11/22		
4.	Copper Nitrate	32-34	21/11/22		
5.	Ferrous Sulphate	35-37	23/11/22		
6.	Zinc Sulphate	38-40	25/11/22		
7.	Aluminium Nitrate	41-43	28/11/22		
8.	Ammonium Acetate	44-46	28/11/22		
9.	Barium Chloride	50-52	30/11/22		
10.	Barium Acetate	47-49	2/12/22		
11.	Lead Nitrate	53-55	5/12/22		
12.	Calcium Nitrate	56-58	7/12/22		

Index

Sr. No	Name of the Experiment	Page No	Date of Experiment	Date of Submission	Remarks
13.	Copper Sulphate	59-61	9/12/22		
14.	Nickel Nitrate	62-64	12/12/22		
15.	Manganese Sulphate	65-69	14/12/22		
IV.	Organic compounds				
1.	Analysis of organic compound - 1	68	16/12/22		
2.	Analysis of organic compound - 2	69	19/12/22		
3.	Analysis of organic compound - 3	70	21/12/22		
4.	Analysis of organic compound - 4	71	23/12/22		
5.	Analysis of organic compound - 5	72	27/12/22		
6.	Analysis of organic compound - 6	73	29/12/22		
7.	Analysis of organic compound - 7	74	31/12/22		
8.	Analysis of organic compound - 8	75	31/01/23		
V.	Colloidal solution				
	Preparation of lyophilic solution and lyophobic solution.	76-81	5/01/23		
VI.	Chromatography				
1.	Pigment separation from leaves	82-83	7/01/23		
2.	Separation of cation and anion.	84-85	7/01/23		
3.	Carbohydrates	86	9/01/23		
4.	Proteins.	87	9/01/23		

Expt. No.



A. Basic Laboratory techniques

→ Cutting a glass tube and glass rod:

Cutting a glass tube is primarily required for making U-shaped tubes, delivery tubes and other purposes for cutting a glass tube proceed in the following manner.

1. Select a glass tube free of cracks.
2. Place it on the bench, hold it firmly and make a single deep scratch with triangular file, donot apply too much pressure.
3. Place the thumbs on each side of the scratch at equal distance from it. Apply gentle pressure and give a quick bending motion towards you until it breaks smoothly.

Precautions:

1. Make a single deep scratch at the desired length with one stroke of the file.

2. Bending a Glass tube:

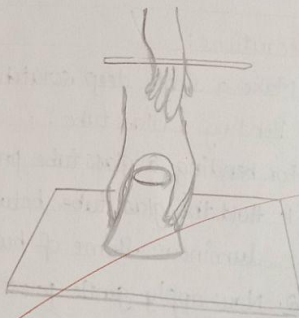
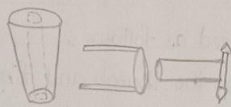
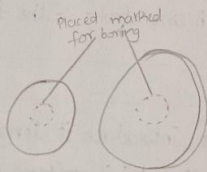
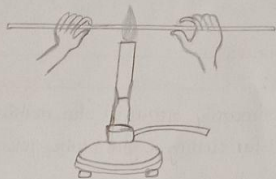
For bending a glass tube proceed as follows:

1. Hold the glass tube between the thumb and fingers, introduce it lengthwise in the luminous flame of burner. Keep the tube rotating till it softens.
2. Now apply gentle pressure so that it bends by itself. When the desired angle is formed, remove the tube from the flame.
3. Place the bent limb on the asbestos sheet. Press it gently so as to make it coplanar. Allow the tube to cool.

Precautions:

1. Select a glass tube of sufficient length to keep your hands safe from heat donot try to bend very small glass tubes of the lengths less than 20cm.
2. While heating, the glass tube should be rotated in order to ensure uniform heating.

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3. Drawing out a glass jet :

1. Take a glass tube of required length and diameter. Hold it with both hands and place it lengthwise in flame (fig. 4).
2. Keep rotating the tube so as to ensure uniform heating, continue heating till it softens.
3. Take the tubing out of the flame and gently pull the two ends apart, the middle portion is drawn out to a thickness of about 2mm.
4. Tool and cut the narrow portion with a triangular file and two jets will be obtained finally round the ends of the jets by heating in a flame for a short while.

4. Boring a cork :

Boring a cork is required for setting up an apparatus for the preparation of gas and for carrying out distillation etc.

1. Softening of the cork : Simply press the wetted cork under your shoes after wrapping the cork in a piece of paper.
2. Selection of the borer : Choose a borer slightly smaller in diameter than that of the tube to be fitted in the cork, this will ensure tight fitting of the tube.
3. Boring of the cork : Place the cork on the table with its narrow end upward. Mark the position of the borer on the both the sides of the cork to ensure straight hole holding the cork tightly with left hand. Apply force on the borer on the both with a twisting motion. Apply some glycerine to the borer if it is a rubber cork. Glycerine acts as lubricant for the hard rubber case. When half of the cork has been bored, take the borer out and reverse the cork start the process of boring taking care that the borer remains vertical throughout. Remove the borer after the cork has been bored from one face to the other. Remove the pieces of the cork inside by inserting the needle.

Fitting the glass tube in the bore :

Wet the cork with water or glycerine. Wet the end of the tube also with water or

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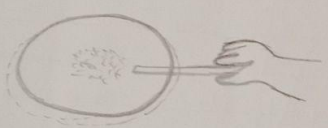
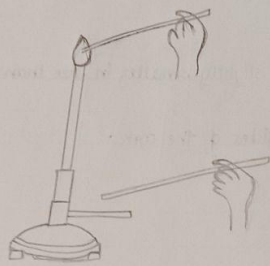
glycerine. Hold the cork in one hand say hand and tube in the right hand. It should be noted that the tube should be held closely from the wetted end. Insert the tube into the bore giving a rotatory motion.

Precautions :

1. Select bore of diameter slightly smaller in size than that of the tube to be inserted in to the hole.
2. Make a mark on both sides of the cork.

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Diagram 1: A Bunsen burner is shown with a flame. A hand is holding a test tube and heating it in the flame. The test tube is held at an angle, and the flame is at the bottom of the test tube.



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B - Characterisation and purification of chemical substances

The Melting point of a substance may be defined as the temperature at which the substance changes from the solid state to the liquid state.

The boiling point of a liquid may be defined as the temperature at which the vapour pressure of the liquid is equal to the atmospheric pressure exerted upon the liquid surface.

The normal boiling point of a liquid may be defined as the temperature at which vapour pressure of the liquid is equal to one standard atmospheric pressure.

Experiment 1 : To determine the melting point of the given organic compound.

Procedure 1 : Powder the crystalline compound take a capillary tube and seal its one end by heating. Fill small amount of the compound into it. For filling the compound make a heap of the powdered compound on the porous plate. Push the open end of the capillary tube into the heap. Some compound will enter into it. capillary tube, on the porous plate gently. Fill the capillary tube upto 2-3 mm.

2. Attach the capillary tube to a thermometer which is immersed in a bath of suitable liquid. The surface tension of the bath liquid is sufficient to hold the capillary tube in position.

3. Heat the beaker slowly and go on stirring the liquid in the beakers so that the temperature remains uniform throughout. For this a glass loop stirrer is moved up and down. When the temperature in which is of the melting point of the pure compound, the flame is lowered. Now the temperature is allowed to rise slowly.

4. The temperature is noted when the compound starts melting. The temperature is noted again when it is completely melted. The average of the two readings gives the melting point of the compound.

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Observation :

Temperature at which the unknown compound begins to melt = $t_1^\circ\text{C}$.

Temperature at which the compound completely melts = $t_2^\circ\text{C}$.

Melting point of the unknown compound = $\left[\frac{t_1 + t_2}{2} \right]^\circ\text{C}$

Precautions :

1. Use dry and powdered sample for the determination of melting point.
2. Keep the lower end of the capillary tube and the thermometer at the same level.
3. Packing of the powder should be uniform without any big air gaps in between the solid particles.

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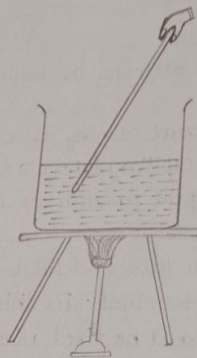
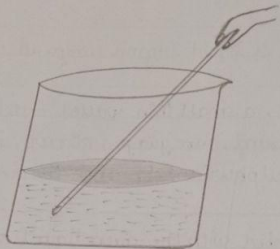
Experiment 2: To determine the boiling point of liquid organic compound.

Requirements: 100ml conning glass beaker, a small thin walled test tube, thermometer, a capillary tube, a tripod stand, wire gauge, stirrer, iron stand with clamp, liquid paraffin or conc. sulphuric acid and the given liquid.

Procedure:

1. Take small test tube and fill it two-third with the given liquid whose boiling point is to be determined. Fix this tube to the thermometer with rubber band. The rubber band should be fixed near the mouth of the tube so that it remains outside the liquid paraffin bath. Adjust the tube so that the bottom of the tube is somewhere at the middle of the tube is somewhere at the middle of the thermometer bulb.
2. Clamp the thermometer carrying test tube in an iron stand through a cork. Lower the thermometer along with the tube into a liquid paraffin bath. Adjust the thermometer so that its bulb is well under the acid and open end of the tube, with the rubber band is sufficiently outside the acid bath.
3. Take a capillary tube 5-6cm in length and seal it at about one cm from one end by heating it in flame and giving a slight twist. Place this capillary in the test tube so that sealed part is at the end of the tube.
4. Start heating the liquid paraffin bath slowly and stir the bath gently. Keep an eye on the liquid and the test tube and also on the thread of the mercury in the thermometer. As first a bubble or two will be seen escaping at the end of the capillary dipping in the liquid, but soon a rapid and continuous stream of air bubbles escape from it. This is the stage when the vapour pressure of the liquid in the sealed capillary first exceeds the atmospheric pressure. Note the temperature when continuous stream of bubbles starts coming out. Remove the flame and note the temperature when the evolution of bubbles from the end of the capillary tube just stops. The mean of these two temperatures gives the boiling point of the liquid.

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5. Allow the temperature fall by 10°C and repeat the heating and again note the boiling point.

Observation: Boiling point 1) $t_1^\circ\text{C}$ 2) $t_2^\circ\text{C}$ Mean $\left[\frac{t_1+t_2}{2}\right]^\circ\text{C} = t_c$

Precautions:

1. Keep the lower end of the ignition tube and the thermometer bulb at the same level.
2. Record the temperature as the boiling point at which brisk and continuous evolution of the bubbles starts from the lower end of the capillary tube dipped in the liquid organic compound.
3. If on placing the sealed capillary tube in the test tube, the liquid is seen rising in the capillary tube, it indicates that the capillary is not properly sealed. Reject this capillary tube and use a sealed new one.

Crystallization of impure sample of any one of the following:
Alum, copper sulphate, benzoic acid.

Process of crystallisation: The process of crystallisation involves following steps:

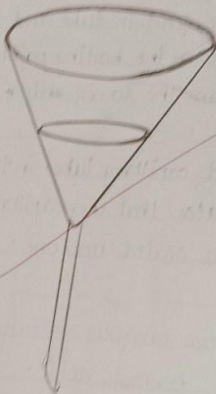
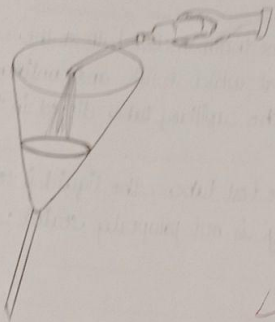
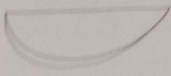
I. Preparation of solution of the impure sample:

1. Take a clean beaker (250 ml) and add powdered impure sample under consideration to it ($\sim 6.0\text{ gm}$).
2. Add distilled water (25-30 ml) and stir the contents gently with the help of glass rod giving circular motion.
3. The solution in the beaker is heated ($60-70^\circ\text{C}$) on a wire gauze.
4. Stir the solution continuously and add more of impure substance till no more of it dissolves.

II. Filtration of hot solution:

1. Take a circular filter paper. First fold it one-half, then fold it one-fourth as shown in fig open the filter paper, three-fold on one side and one-fold

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1. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a circle.
2. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a semi-circle.
3. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a sector of a circle.
4. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a circle.
5. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a semi-circle.
6. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a sector of a circle.
7. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a circle.
8. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a semi-circle.
9. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a sector of a circle.
10. Take a cone of paper and fill it with water. Pour the water out and observe the shape of the water left in the cone. It is a circle.

on the other side to get a cone.

2. Take a funnel and fit the filter paper cone into the funnel so that the upper half of the cone fits well into the funnel but lower part remains slightly away from the funnel.

3. Wet the filter paper cone with a spray of water - from a wash bottle pressing the upper part of the filter paper cone against the wall of the funnel with the thumb.

4. Place the funnel stand and place a clean china dish below the funnel for the collection of the filtrate. To avoid splashing of a filter, adjust the funnel so that its stem touches the wall of the dish.

5. Hold a glass rod in standing position in your hand or with a precaution that the lower end of the rod should reach into the filter paper cone, but it doesn't touch it. Pour the solution along the glass rod as shown in fig 3.5 the filtrate passes through the filter paper and it collected into the china dish placed below. The insoluble impurities are left behind on the filter paper.

III. Concentration of filtrate:

1. Place the dish containing the clear filtrate over wire gauge, kept over a tripod stand and heat it gently (don't boil) stir the solution with a glass rod this is done to ensure uniform evaporation and to prevent formation of solid crust.

2. When the volume of the solution is reduced to one-half, take out a drop of the concentrated solution on one end of glass rod and cool it by blowing air formation of thin crust indicates that crystallization point has reached.

3. Stop heating by removing the burner.

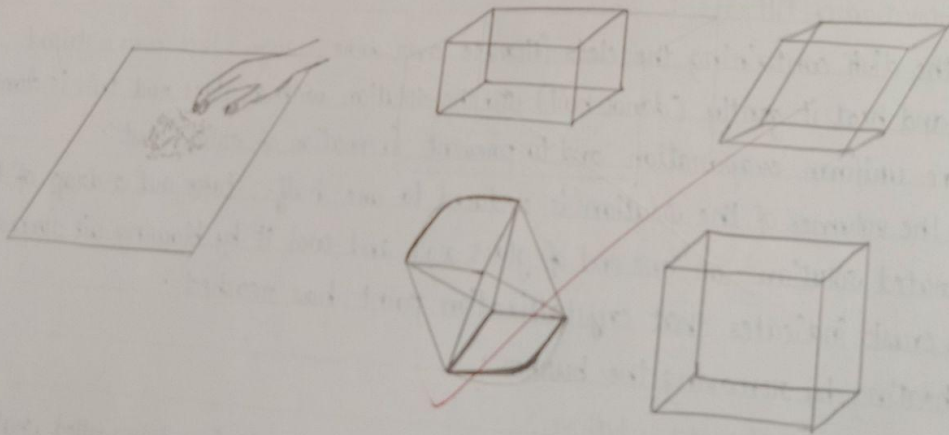
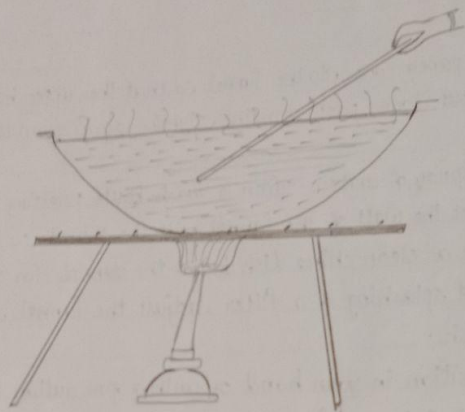
IV. Cooling the concentrated solution:

1. Pour the concentrated solution into a crystallizing dish. (it is a thin walled shallow glass dish with a flat bottom and vertical sides it has a spout to pour of the mother liquor).

2. Cover the dish with a watch glass and keep it undisturbed.

3. As the solution cools, crystals separate out the concentrated solution is cooled slowly for better yield of the crystals.

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Sometimes the china dish containing the concentrated solution is cooled by placing on a beaker filled to the brim with cold water. cooling may also be done by keeping the china dish in open air depending upon the weather conditions.

V. Separation and drying of crystals :

1. Decant off the mother liquor, and wash the crystals with cold water or alcohol.
2. Dry the crystal by pressing them gently between the sheets of filter paper. The crystals can be dried by spreading them on a porous plate for some times or by placing the crystals in vacuum dessicator.

Crystals have definite geometry and therefore definite shape, potash alum comes out in octahedral, geometry potassium nitrate crystals are needle like and ferrous sulphate have monoclinic shape.

Experiment 3.1: To prepare crystals of pure copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) from a given impure sample of the blue vitriol.

Procedure:

1. Take about 25-30ml of water and add to it small quantities of the powdered crude copper sulphate stir well to dissolve it make several additions of the powdered sample till a little of it remains undissolved even it is stirred for sometime. Now add 4-5ml of dilute sulphuric acid to make the solution clear this prevents hydrolysis of the copper sulphate.
2. Filter the solution and collect the filtrate in a china dish the insoluble impurities are left as residue on the filter paper.
3. Heat the solution in the china dish on a wire gauge till the crystallisation point has reached now turn off the burner and stop heating transfer the hot saturated solution in a crystallisation dish.
4. Place the crystallisation dish containing hot saturated solution on a beaker containing water filled to the brim and allow it to cool slowly for sometime deep blue crystals of copper sulphate will appear.
5. Decant off the mother liquor carefully without disturbing the crystals wash the crystals with a little ethyl alcohol containing small amount of cold water to remove the mother liquor sticking to them.
6. Remove the crystals on a filter paper which soaks the solution transfer the crystals on another filter paper and dry them by pressing gently between the folds of a filter paper and dry them by pressing gently between the folds of a filter paper.

The crystals of pure copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) are triclinic, transparent blue.

Precautions:

1. The filtrate should be evaporated slowly by gently heating during concentration.
2. The filtrate is to be evaporated only up to the crystallisation point it should never be heated to dryness avoid over-heating of the solution.

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Experiment 3.2 : To prepare the crystals of potash alum, $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ from the crude sample.

Procedure :

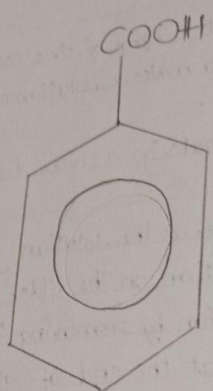
1. Take a 400ml beaker put in it about 5-gms of the crude sample and 25-30ml water stir the contents of the beaker to make a solution clear warm to dissolve the whole of alum present in the sample.
2. Filter the solution and collect the filtrate in a china dish the insoluble impurities are left as residue on the filter paper.
3. Heat the china dish on a wire gauge, as the solution gets heated up it is stirred well with a glass rod to avoid crust formation on the side of the dish if the crust is formed it is dissolved into the solution by removing it with glass rod.
Take out a drop of a solution at the end of glass rod and cool it by blowing the appearance of a thin crust on the glass rod shows that the crystallisation point has reached stop heating at this stage.
4. Place the dish containing hot saturated solution on a beaker containing water filled to the brim and allow it to cool slowly for sometime colourless crystals of alum begin to separate.
5. Decant off the mother liquor carefully wash the crystals with cold solution of alcohol and water remove the crystals on a filter paper which soaks the solution transfer the crystals on another filter paper and dry them by pressing gently between the fold of a filter paper transfer the crystals into a dry test tube, and cork it.

The crystals of pure potash alum are colourless, transparent and octahedral.

Precautions :

1. The filtrate should be evaporated slowly by gently heating during concentration.
2. The filtrate is to be evaporated only up to the crystallisation point it should never be heated to dryness avoid over heating of the solution.

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Experiment 2.3: To purify impure sample of benzoic acid by the process of crystallisation.

Theory: Benzoic acid is a crystalline solid that has moderate solubility in hot water and low solubility in cold water.

Its molecular structure is:

Benzoic acid is recrystallized by dissolving in hot water.

Requirement: Crude sample of benzoic acid, 250ml beakers (two) funnel a trough.

Procedure:

1. Preparation of solution: Take about 150ml of water in a 250ml beaker and keep it for boiling on a tripod stand and wire gauge in another 250ml beaker take 2-3gm of the crude sample of benzoic acid and add gradually with stirring minimum quantity of boiling water just sufficient to dissolve benzoic acid heating can be done if required.
2. Filtration of the solution: Filter the hot solution immediately using fluted filter paper placed in a funnel insoluble impurities will be left on a filter paper.
3. Cooling the hot saturated solution: Let the filtered solution come to room temperature buy it self now cool it by placing in cold water through.
4. Separation of crystals and dry in separate the crystals by filtration using funnel and filter paper wash the crystals with cold water.
5. Transfer the crystals on another filter paper and then by pressing gently between the folds of a filter paper transfer the crystals into a dry test tube and cork it.

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Expt. No. _____

Date _____

Page No. 13

Quantitative Estimation

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Observations		Burette readings		Volume of NaOH run down (b-a)
S. No	Volume of oxalic acid	Initial (a)	Final (b)	
1.	20 ml	0 ml	19.5 ml	19.5
2.	20 ml	0 ml	19.5 ml	19.5
3.	20 ml	0 ml	19.5 ml	19.5

$$\text{Formula: } \frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

M_1 = Molarity of NaOH solution = ?

V_1 = Volume of NaOH solution = 19.5

n_1 = number of moles of NaOH acid = 2

M_2 = Molarity of oxalic acid solution = 0.1M

V_2 = Volume of oxalic acid solution = 20 ml

n_2 = number of moles of oxalic acid = 1

Calculation:

$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

$$M_1 = \frac{M_2 V_2}{n_1} \times \frac{n_2}{V_1}$$

$$M_1 = \frac{0.1 \times 20}{1} \times \frac{2}{19.5}$$

$$M_1 = 0.2M$$

$$W = \frac{M \times \text{GMW} \times V}{1000}$$

$$W = \frac{0.2 \times 40 \times 500}{1000}$$

$$W = 4.00 \text{ gm}$$

Estimation of NaOH with oxalic acid

Aim: Estimate the amount of NaOH present in 50ml of given solution of given solution 0.05M oxalic acid supplied.

Apparatus: Burette, pipette, conical flask.

Principle: $\text{H}_2\text{C}_2\text{O}_4 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{C}_2\text{O}_4 + 2\text{H}_2\text{O}$
1 mole of $\text{H}_2\text{C}_2\text{O}_4 = 2$ mole of NaOH.

Indicator: Phenolphthalein.

End point: Colourless to pale pink.

Procedure: 20ml of the given oxalic acid solution is pipetted out into a conical flask. One drop of phenolphthalein is added. Burette is filled with given NaOH solution. Oxalic acid is titrated against NaOH with constant shaking till the solution turns to pale pink. This is the end point. The titration is stopped. Then reading is noted in tabular form. The experiment is repeated until two same values are obtained.

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

Result: The amount of NaOH present in 50ml of given sol is 2.0gm.

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Observations		Burette readings		Volume of HCl solution readout (b-a)
S. No	Volume of Na_2CO_3 solution	Initial (a)	Final (b)	
1.	20 ml	0 ml	18.5 ml	18.5
2.	20 ml	0 ml	18.5 ml	18.5
3.	20 ml	0 ml	18.5 ml	18.5

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

M_1 = Molarity of HCl solution = ?

V_1 = Volume of HCl solution = 18.5

n_1 = number of moles of HCl = 2

M_2 = Molarity of Na_2CO_3 solution = 0.05

V_2 = Volume of Na_2CO_3 solution = 20 ml

n_2 = number of moles of Na_2CO_3 = 1

Calculation:

$$M_1 = \frac{M_2 V_2}{n_1} \times \frac{n_2}{V_1}$$

$$= \frac{0.05 \times 20 \times 2}{1 \times 18.5}$$

$$= 0.1$$

$$M = \frac{W}{M} \times \frac{1000}{V}$$

$$W = \frac{0.1 \times 36.5 \times 100}{1000}$$

$$= \frac{3.65}{1000}$$

$$= 0.365 \text{ gm/l}$$

Estimation of HCl with Na_2CO_3 .

Aim: Estimate the amount of HCl present in 100ml of given solution. 0.05M Na_2CO_3 solution is applied.

Apparatus: Burette, Pipette, conical flask.

Principle: $2\text{HCl} + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
2 mole of HCl = 1 mole of Na_2CO_3 .

Indicator: Methyl orange.

End point: Pale yellow to pale pink.

Procedure: 20ml of the given Na_2CO_3 solution is pipetted out into the conical flask. One drop of methyl orange is added. The solution turned pale yellow. Burette is filled with given HCl solution. Na_2CO_3 is titrated against HCl with constant shaking till the solution turns to pale pink. This is the end point. The titration is stopped. Then reading is noted in tabular form. The experiment is repeated until two same values are obtained.

$$\text{Formula: } \frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

Result: The amount of HCl solution present in the 100ml of solution is 0.365gm

Teacher's Signature _____

Observations		Burette readings		Volume of KMnO_4 solution used (b-a)
S. No	Volume of oxalic acid solution	Initial (a)	Final (b)	
1.	20 ml	0 ml	19.5 ml	19.5 ml
2.	20 ml	0 ml	19.5 ml	19.5 ml
3.	20 ml	0 ml	19.5 ml	19.5 ml

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

M_1 = Molarity of KMnO_4 = ?

V_1 = Volume of KMnO_4 = 19.5

n_1 = number of moles of KMnO_4 = 2

M_2 = Molarity of $\text{H}_2\text{C}_2\text{O}_4$ solution = 0.05

V_2 = Volume of $\text{H}_2\text{C}_2\text{O}_4$ solution = 20 ml

n_2 = number of moles of $\text{H}_2\text{C}_2\text{O}_4$ = 5

Calculation:

$$M_1 = \frac{M_2 V_1 \times n_2}{n_1 V_2}$$

$$= \frac{0.05 \times 20 \times 2}{5 \times 19.5}$$

$$= \frac{4}{1.95} = 0.02$$

Molarity of KMnO_4 = 0.02

$$W = \frac{M \times m \times V}{1000}$$

$$= \frac{0.02 \times 158 \times 500}{1000}$$

$$= 1.58 \text{ gm}$$

Estimation of KMnO_4 with oxalic acid solution.

Aim: Estimate the amount of KMnO_4 present in some of given solution. 0.05M oxalic acid solution is supplied.

Apparatus: Burette, Pipette, Conical flask.

Principle: $2\text{KMnO}_4 + 5\text{H}_2\text{C}_2\text{O}_4 + 3\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 10\text{CO}_2\uparrow + 8\text{H}_2\text{O} + 2\text{MnSO}_4$
2 mole of $\text{KMnO}_4 = 5$ moles of $\text{H}_2\text{C}_2\text{O}_4$.

Indicator: KMnO_4 itself acts as self indicator.

End point: Colourless to pale pink.

Procedure: Burette is filled with given KMnO_4 solution upto the mark. 20ml of oxalic acid solution is taken into conical flask with pipette. Some amount of dilute H_2SO_4 is added with a measuring jar to the oxalic acid solution. The mixture is heated up to 60°C to 70°C by heating. The hot solution is titrated against standard KMnO_4 until the colour is changed to permanent pale pink. The volume of KMnO_4 run-down is noted in the tabular form. This experiment is repeated until two same values are obtained.

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

Result: The amount of KMnO_4 present in given some of given solution is
1.58 gm

Teacher's Signature _____

Observations				
S.No	Volume of Mohr's Salt solution	Burette Readings		Volume of $KMnO_4$ solution run down (b-a)
		Initial (a)	Final (b)	
1.	20 ml	0 ml	20 ml	20 ml
2.	20 ml	0 ml	20 ml	20 ml
3.	20 ml	0 ml	20.5 ml	20.5 ml

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

M_1 = Molarity of $KMnO_4$ = ?

M_2 = Molarity of Mohr's salt = 0.1

V_1 = Volume of $KMnO_4$ = 20 ml

V_2 = Volume of Mohr's salt = 20 ml

n_1 = number of moles of $KMnO_4$ = 2

n_2 = number of moles of Mohr's salt = 10

Calculation:

$$M_1 = \frac{M_2 V_1}{n_1} \times \frac{n_2}{V_2}$$

$$= \frac{0.1 \times 20 \times 10}{2 \times 20} = \frac{10}{20} = 0.02$$

$$W = \frac{M \times G.M.W \times V}{1000}$$

$$W = \frac{0.02 \times 158 \times 500}{1000}$$

$$W = 1.58 \text{ gm}$$

Estimation of KMnO_4 with standard ferrous ammonium sulphate solution.

Aim: Estimate the amount of KMnO_4 present in 50ml of given solution 0.1M ferrous ammonium sulphate (Mohr's salt) solution is supplied.

Apparatus: Burette, pipette, conical flask.

Principle: $2\text{KMnO}_4 + 10\text{FeSO}_4 + 8\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 5\text{Fe}_2(\text{SO}_4)_3 + 8\text{H}_2\text{O} + 2\text{MnSO}_4$
2 mole of KMnO_4 = 10 moles of FeSO_4 .

Indicator: KMnO_4 itself acts as self indicator.

End point: Colourless to pale pink.

Procedure: Burette is filled with given KMnO_4 solution upto the mark. 20ml of Mohr's salt solution is taken into conical flask with pipette. Same amount of dilute H_2SO_4 is added with a measuring jar to the Mohr's salt solution. Then it is titrated against standard KMnO_4 until the colour is changed to permanent pale pink. The volume of KMnO_4 run-down is noted in the tabular form. This experiment is repeated until two same values are obtained.

$$\text{Formula: } \frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

Result: The amount of KMnO_4 present in 50ml of solution is 1.59gm

Teacher's Signature _____

Observations

S.No	Volume of oxalic acid solutions	Burette readings		Volume of NaOH solution used (ml)
		Initial (a)	Final (b)	
1.	20ml	0ml	19.5ml	19.5ml
2.	20ml	0ml	19.5ml	19.5ml
3.	20ml	0ml	19.5ml	19.5ml

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

M_1 = Molarity of oxalic acid = ?

V_1 = Volume of oxalic acid = 20ml

n_1 = number of moles of oxalic acid = 1

M_2 = Molarity of NaOH solution = 0.05

V_2 = Volume of NaOH solution = 19.5

n_2 = number of moles of NaOH = 2

Calculation:

$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

$$M_1 \times \frac{20}{1} = \frac{0.05 \times 19.5}{2}$$

$$= \frac{0.05 \times 19.5}{2 \times 20 \times 100}$$

$$= \frac{1.95}{8 \times 100}$$

$$= 0.02M$$

$$W = \frac{M \times G.M.W. \times V}{1000}$$

$$= \frac{0.02 \times 120 \times 500}{1000}$$

$$= 3.18g$$

Estimation of oxalic acid with KMnO_4 .

Aim: Estimate the amount of oxalic acid present in 100ml of given solution.
0.02M KMnO_4 solution is supplied.

Apparatus: Burette, Pipette, Conical flask.

Principle: $2\text{KMnO}_4 + 5\text{H}_2\text{C}_2\text{O}_4 + 3\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 10\text{CO}_2\uparrow + 8\text{H}_2\text{O} + 2\text{MnSO}_4$
5 moles of $\text{KMnO}_4 = 5$ moles of $\text{H}_2\text{C}_2\text{O}_4$.

Indicator: KMnO_4 itself acts as self indicator.

End point: Colourless to pale pink.

Procedure: Burette is filled with given KMnO_4 solution up to the mark. 20ml of oxalic acid solution is taken into conical flask with pipette. Same amount of dilute H_2SO_4 is added with a measuring jar to the oxalic acid solution. The mixture of that is heated up to 60°C to 70°C by heating. The hot solution is titrated against standard KMnO_4 until the colour is changed to permanent pale-pink. The volume of KMnO_4 consumed is noted in the tabular form. This experiment is repeated until two same values are obtained.

Formula:
$$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}$$

Result: The amount of oxalic present in the given 500ml of solution is ~~3.25gm~~ 3.25gm.

Teacher's Signature _____

Observations

S.No	Volume of Mohr's salt solution	Burette Readings		Volume of $KMnO_4$ solution run-down (b-a)
		Initial (a)	Final (b)	
1.	20ml	0ml	20ml	20ml
2.	20ml	0ml	20ml	20ml
3.	20ml	0ml	20ml	20ml

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

M_1 = Molarity of Mohr's salt = ?

V_1 = volume of Mohr's salt = 20ml

n_1 = number of moles of Mohr's salt = 1

M_2 = Molarity of $KMnO_4$ solution = 0.01

V_2 = volume of $KMnO_4$ solution = 18.5ml

n_2 = number of moles of $KMnO_4$ = 2

Calculation:

$$M_1 = \frac{M_2 V_2}{n_2} \times \frac{n_1}{V_1}$$

$$= \frac{18.5}{20 \times 2 \times 100}$$

$$= \frac{18.5}{40 \times 100}$$

$$= 0.04$$

$$W = \frac{0.04 \times 10.6 \times 100}{1000}$$

$$W = 0.3924 \text{ gm}$$

Estimation of Ferrous ammonium sulphate with standard KMnO_4 solution.

Aim: Estimate the amount of ferrous ammonium sulphate (Mohr's salt) present in 50ml of given solution. 0.02M KMnO_4 solution.

Apparatus: Burette, Pipette, Conical flask.

Principle: $2\text{KMnO}_4 + 10\text{FeSO}_4 + 8\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 5\text{Fe}_2(\text{SO}_4)_3 + 8\text{H}_2\text{O} + 2\text{MnSO}_4$
2 moles of KMnO_4 = 10 moles of FeSO_4 .

Indicator: KMnO_4 itself acts as self indicator.

Endpoint: Colourless to pale pink.

Procedure: Burette is filled with given KMnO_4 solution up to the mark. 20ml of Mohr's salt solution is taken into conical flask with pipette. Same amount of dilute H_2SO_4 is added with a measuring jar to the Mohr's salt solution. Then it is titrated against standard KMnO_4 until the colour is changed to permanent pale pink. The volume of KMnO_4 run-down is noted in the tabular form. This experiment is repeated until two same values are obtained.

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$ $M_2 = \frac{M_1 V_1}{n_1} \times \frac{n_2}{V_2}$

Result: The amount of Mohr's salt present in given 50ml of solution is
0.3924 gm.

Teacher's Signature _____

Observations				
S.No	Volume of oxalic acid	Burette reading		Volume of NaOH standard (b-a)
		Initial (a)	Final (b)	
1.	20ml	0ml	19.5ml	19.5ml
2.	20ml	0ml	19.5ml	19.5ml
3.	20ml	0ml	19.5ml	19.5ml

$$\text{Formula: } \frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

M_1 = Molarity of oxalic acid = ?

V_1 = Volume of oxalic acid = 20ml

n_1 = number of moles of oxalic acid = 1

M_2 = Molarity of NaOH solution = 0.05

V_2 = Volume of NaOH solution = 19.5

n_2 = no. of moles of NaOH = 2

Calculation:

$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

$$M_1 \times \frac{20}{1} = \frac{0.05 \times 19.5}{2}$$

$$= \frac{0.05 \times 19.5}{2 \times 20 \times 100}$$

$$= \frac{19.5}{8 \times 1000}$$

$$= 0.02 \text{ M}$$

$$W = \frac{M \times \text{GMW} \times V}{1000}$$

$$= \frac{0.02 \times 126 \times 5}{1000}$$

$$= \frac{2 \times 126 \times 5}{1000}$$

$$= \frac{126}{1000}$$

$$= 1.26 \text{ gm}$$

Estimation of oxalic acid with NaOH.

Aim: Estimate the amount of oxalic acid present in 50 ml of given solution by using standard 0.05M of NaOH solution as supplied.

Apparatus: Burette, pipette, conical flask, beaker.

Principle: $\text{H}_2\text{C}_2\text{O}_4 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{C}_2\text{O}_4 + 2\text{H}_2\text{O}$

1 mole of oxalic acid = 2 mole of NaOH

Indicator: Phenolphthalein.

Endpoint: Colourless to pale pink.

Procedure: 20 ml of oxalic acid pipette out in to a clean conical flask and add one or two drops of phenolphthalein indicator is added. Burette is filled with given NaOH solution upto the mark.

Oxalic acid is titrated against NaOH solution. The solution turns to pale pink. This is the end point and turns to pale pink. Reading are noted in tabular form.

The experiment is repeated until two values are obtained.

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

Result: The amount of oxalic acid present in the given 50 ml of solution is 1.26 gm

Teacher's Signature _____

Observations				
S.No	Volume of Na_2CO_3 (ml)	Burette Readings		Volume of HCl read down (b-a)
		Initial (a)	Final (b)	
1.	20 ml	0 ml	18.5 ml	18.5 ml
2.	20 ml	0 ml	18.5 ml	18.5 ml
3.	20 ml	0 ml	18.5 ml	18.5 ml

Formula: $\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$

M_1 = Molarity of Na_2CO_3 solution = ?

V_1 = Volume of Na_2CO_3 solution = 20 ml

n_1 = number of moles of Na_2CO_3 solution = 1

M_2 = Molarity of HCl solution = 0.1

V_2 = Volume of HCl solution = 18.5

n_2 = number of moles of HCl = 0.2

Calculation:

$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

$$M_1 \times 20 = \frac{0.1 \times 18.5}{2}$$

$$M_1 = \frac{0.1 \times 18.5}{2 \times 20}$$

$$M_1 = 0.04 \text{ M}$$

$$W = \frac{M \times \text{GMW} \times V}{1000}$$

$$= \frac{0.04 \times 106 \times 1000}{1000}$$

$$= \frac{4.24}{1000}$$

$$W = \frac{4.24}{1000} = 0.42 \text{ gm}$$

Estimation of Na_2CO_3 with HCl .

Aim: Estimate the amount of Na_2CO_3 present in 100ml of given solution by using standard 0.1M of HCl solution is supplied.

Apparatus: Burette, Pipette, conical flask, beaker.

Principle: $2\text{HCl} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
2 mole of $\text{HCl} = 1$ mole of Na_2CO_3

Indicator: Methyl orange

End point: Pale pink to pale yellow.

Procedure: 20 ml of Na_2CO_3 pipette out into a clean conical flask. Add (1) or (2) drops of methyl orange indicators to the solution. Burette is filled with constant NaOH solution upto the mark. Na_2CO_3 titrated against HCl with constant shaking and the solution turns to pale pink. This is the end point and stop titration. The values are noted in a tabular form.

Formula:
$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2}$$

Report: The amount of Na_2CO_3 present in 100ml of given solution is 0.42gm

Teacher's Signature _____

Ammonium Sulphate - 1

Experiment	Observation	Inference
<u>Preliminary Tests :</u>		
a) Colour	Colourless	Cu^{+2} , Fe^{+2} and Mn^{+2} salts are absent
b) Physical state	Crystalline	-
c) Action of heat :	Colourless gas with smell of NH_3 evolved along with formation of white sublimate inside the test tube.	May be ammonium salt.
A small quantity of the given salt is heated in a dry test tube first gently and then strongly.		
d) Flame test :	No characteristic flame is observed.	Ca^{+2} , Sr^{+2} , Ba^{+2} , Cu^{+2} , Zn^{+2} are absent.
A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.		

Identification of Anion

1. Action of dil. HCl :	No characteristic reaction is observed.	Carbonate (CO_3^{2-}) and acetate (CH_3COO^-) are absent
To the small quantity of salt few drops of dil. HCl is added.		
2. Action of conc. H_2SO_4 :	No characteristic reaction is observed.	Cl^- , Br^- , I^- , NO_3^- are absent.
To the small quantity of salt few drops of conc. H_2SO_4 is added.		

Teacher's Signature _____

Expt. No. _____

3. Action of MnO_2 and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . This mixture is treated with conc. H_2SO_4 and heated gently.	No characteristic reaction is observed.	Cl^- , Br^- , I^- are absent.
4. Action of $BaCl_2$ solution: To the salt solution $BaCl_2$ solution is added.	A white ppt is formed. This ppt is insoluble in conc. HCl .	Sulphate (SO_4^{2-}) is present.

Wet Tests:

Preparation of sodium carbonate extract: A small quantity of the salt is mixed with triple amount of anhydrous sodium carbonate. Distilled water is added, shake well and boil for about five minutes. It is filtered. The filtrate is known as sodium carbonate extract. The filtrate is tested for Cl^- , Br^- , NO_3^- and SO_4^{2-} ions.

Confirmatory Test for sulphate ion.

Neutralise Na_2CO_3 extract with dil. HCl and $BaCl_2$ solution is added.	A white precipitate ($BaSO_4$) is formed which is insoluble in conc. HCl .	Sulphate (SO_4^{2-}) is confirmed.
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Teacher's Signature _____

Identification of Cation

Experiment Test for	Observation	Inference
Ammonium ion (NH_4^+): A small amount of salt is heated with NaOH solution.	Colourless gas with ammonia smell is evolved which gives white dense fumes when a glass rod dipped in conc. HCl is exposed.	May be ammonium (NH_4^+) ion.

Preparation of original solution:

The solution prepared by dissolving the given salt in a suitable solvent in which it is soluble. It is prepared for identification of cations.

Group Separation Table

To the original salt solution dil. HCl is added.

No ppt Has gas is passed through the above solution.

I-group No ppt The original salt solution is saturated with solid

cation is II-group NH_4Cl and NH_4OH solution is added in excess.

absent cation is No ppt Has is passed through the above solution

absent III-group No ppt The original salt solution is

cation is IV-group saturated with NH_4Cl , NH_4OH

absent cation is and $(\text{NH}_4)_2\text{CO}_3$ solutions are

absent added.

No ppt Original sat solution

V-group is tested for

cation is Magnesium. No ppt

absent is formed Magnesium

ion is absent.

Teacher's Signature _____

Expt. No. _____

Date _____

Page No. 05

Confirmatory Test for Cations (NH_4^+)

Experiment	Observation	Inference
a) To the salt, NaOH solution is added and boiled.	A colourless gas with ammonia smell is evolved which gives white dense fumes when a glass rod dipped in conc. HCl is exposed.	Ammonium ion is confirmed.
b) To the salt solution, Nessler's reagent (K_2HgI_4) is added.	Reddish brown precipitate is formed.	Ammonium ion is confirmed.

Report: The given salt contains

Cation: ~~Ammonium ion (NH_4^+)~~

Anion: ~~Sulphate ion (SO_4^{2-})~~

Given salt: ~~Ammonium sulphate [$(\text{NH}_4)_2\text{SO}_4$]~~

Teacher's Signature _____

Ammonium carbonate

Experiment	Observation	Inference
<u>Preliminary Tests :</u>		
a) Colour	Colourless	Cu^{+2} , Fe^{+2} , Mn^{+2} are absent
b) State	Crystalline	—
c) Action of heat : The given salt is taken in a dry test tube and it is first heated gently and then strongly.	A colourless gas with NH_3 smell is observed.	May be ammonium salt.
d) Flame test A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.	No characteristic flame is observed.	Ca^{+2} , Sr^{+2} , Ba^{+2} , Cu^{+2} , Zn^{+2} are absent.

Identification of Anion

i) Action of dil. HCl : To the given salt few ml of dil. HCl is added.	Colourless, odourless gas is evolved with brisk effervescence. The gas puts off a burning splinter and turns lime water milky.	May be carbonate ion is present.
a) Action of conc. H ₂ SO ₄ (in cold condition) : To the given salt few ml conc. H ₂ SO ₄ is added. And heated if necessary.	No characteristic reaction is observed even on strong heating.	Chloride, Bromide, Iodide, Nitrate ions are absent

Teacher's Signature _____

3) Action of MnO_2 and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . This mixture is treated with conc. H_2SO_4 and heated gently.	No characteristic reaction is observed.	Cl^- , Br^- , I^- are absent
4) Action with $BaCl_2$: To the salt solution few ml $BaCl_2$ solution is added.	White ppt. is formed and it is soluble in dil. HCl .	Carbonate ion is confirmed sulphate ion is absent.

Identification of cation

For ammonium ion: Action of $NaOH$. The salt is warmed with few ml of sodium hydroxide solution.	Vapour of ammonia with a characteristic pungent odour are evolved. These vapours produce white dense fumes with a drop of conc. HCl exposed on a glass rod.	Ammonium ion is present.
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Group Separation table.

To the original salt solution dil. HCl is added.

No ppt	H_2 gas is passed through the above solution	
I-group cation is absent	No ppt The original salt solution is saturated with NH_4Cl solid and NH_4OH solution is added in excess.	
	II-group cation is absent	No ppt H_2S gas is passed through the above solution.
	III-group cations are absent	

Teacher's Signature _____

No ppt	The original solution is saturated with NH_4Cl & NH_4OH and $(\text{NH}_4)_2\text{CO}_3$ solutions are added.	
IV-group cations are absent	No ppt	original salt solution is tested for Magnesium. No ppt is formed magnesium ion is absent
	V-group cations are absent	

Confirmation tests for cation (NH_4^+)

for ammonium ion:	Vapour of ammonia with a characteristic pungent odour are evolved.	Ammonium ion is confirmed.
1) Action of NaOH :	These vapours produce white dense fumes with a drop of conc. HCl exposed on a glass rod.	
The salt is warmed with few ml of sodium hydroxide.		
2) Nessler's reagent test:	A brown ppt is formed.	Ammonium ion is confirmed.
To the very dilute salt solution few ml of Nessler's reagent		

Report: The given salt contains

Cation: Ammonium ion (NH_4^+)Anion: Carbonate ion (CO_3^{2-})Given salt: Ammonium carbonate $[(\text{NH}_4)_2\text{CO}_3]$

Barium Bromide

Experiment	Observation	Inference
Preliminary Tests		
a) Colour	Colourless	Cu^{2+} , Fe^{2+} , Mn^{2+} are absent
b) State	Crystalline	—
c) Action of heat : The given salt is taken in a dry test tube, heated gently and then strongly	Water droplets are formed on the walls of the test tube.	May be hydrated salt.
d) Flame test : A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.	Grassy green flame	May be Barium salt

Identification of Anion

1) Action of dil. HCl : To the given salt few ml dil. HCl is added.	No characteristic reaction is observed.	Carbonate, Acetate ions are absent.
2) Action of conc. H_2SO_4 : To the given salt few ml conc. H_2SO_4 is added. And heated if necessary.	A colourless HBr gas along with reddish brown vapours of Br_2 are evolved, the gas turns a drop of AgNO_3 to pale yellow.	May be Bromide ion.
3) Action of MnO_2 and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube & add a pinch of MnO_2 . This mixture is treated with conc.	Reddish Brown vapours are evolved.	May be Bromide ion.

Teacher's Signature _____

H_2SO_4 and heated gently

Wet Tests:

Preparation of sodium carbonate extract: A small quantity of the salt is mixed with triple amount of anhydrous sodium carbonate. Distilled water is added, shake well and boil for about five minutes. It is filtered. The filtrate is known as sodium carbonate extract. The filtrate is tested for Cl^- , Br^- , NO_3^- and SO_4^{2-} ions.

Confirmatory test for Bromide

Neutralise Na_2CO_3

extract with dil. HNO_3 and AgNO_3 solution is added.

A pale yellow precipitate (AgBr) is formed. The precipitate is sparingly soluble in NH_4OH solution.

Bromide is confirmed.

Identification of cation

For ammonium ion:

Action of NaOH solution:

The salt is warmed with few ml of solution hydroxide solution.

No characteristic reaction is observed.

Ammonium ion is absent.

Group separation table

To the original salt solution dil. HCl is added.

No ppt

H_2 gas is passed through the above solution.

I-group

No ppt

The original salt solution is saturated with NH_4Cl solid and NH_4OH solution is added in excess.

cation is

II-group

absent

cation is

absent

Teacher's Signature _____

ppt. (iii)

No ppt.
III group
cation is
absent

III gas is passed through the above solution.
No ppt.
IV group
cations are
absent

The original solution is saturated with NH_4Cl , NH_4OH
and $(\text{NH}_4)_2\text{CO}_3$. Solutions are added.

White ppt. original salt solution is tested for Magnesium.

is formed. No ppt. is formed. Magnesium ion is absent

may be

Barium ion.

(iii) Calcium ion

Confirmation tests for cation (Ba^{2+})

1. To the salt solution
potassium chromate
(K_2CrO_4) solution is
added.

Yellow ppt. is formed,
which is soluble in conc. HCl

Barium ion is
confirmed.

2. To the salt solution
Ammonium oxalate
[(NH_4) $_2\text{C}_2\text{O}_4$] solution is
added.

White precipitate is formed.
It is soluble in acetic acid.

Barium ion is confirmed.

Report: The given salt contains

Cation: Barium ion (Ba^{2+})

Anion: Bromide ion (Br^-)

Given salt: Barium bromide (BaBr_2)

Teacher's Signature _____

Experiment	Copper nitrate	Inference
Preliminary Tests :	Observation	
a) Colour	Blue	May be copper salt.
b) State	Crystalline	
c) Action of heat : The given salt is taken in a dry test tube and it is first heated gently and then strongly.	Reddish brown gas is evolved and it has no action with AgNO_3	May be nitrate.
d) Flame test : -A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.	Dark Green	May be copper salt.

Identification of Anion

1) Action of dil. HCl : To the given salt few ml dil. HCl is added.	No characteristic reactions is observed.	Carbonate, Acetate ions are absent.
2) Action of conc. H_2SO_4 : To the given salt few ml conc. H_2SO_4 is added. And heated if necessary.	Reddish brown gas (NO_2) is evolved on strong heating.	May be Nitrate ion.
3) Action of MnO_2 and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . This	No characteristic reaction is observed.	Cl^- , Br^- , I^- are absent.

Teacher's Signature _____

mixture is treated with conc. H₂SO₄ and heated gently.

ii) Copper Turnings Test: To the given salt few copper turnings and few drops of conc. H₂SO₄ and heated gently.

Reddish brown gas is evolved. Solution turned to blue.

Nitrate ion is present.

iii) Action of / with BaCl₂: The salt solution BaCl₂ solution is added.

No characteristic reaction is observed.

Sulphate ion is absent.

Wet Tests:

Preparation of sodium carbonate extract:

The salt is mixed with three times its bulk of anhydrous sodium carbonate. Sufficient distilled water is added and boiled for about few minutes. It is filtered. The filtrate is known as sodium carbonate extract.

Confirmatory test for Nitrate

Brown ring test:

The extract is neutralised with dil. H₂SO₄ an equal amount of freshly prepared solution of FeSO₄ is added and the test tube is kept in an inclined position and conc. H₂SO₄ is added along the inner sides of the test tube.

A brown ring is formed at the junction of two layers.

Nitrate ion is confirmed.

Teacher's Signature _____

Identification of cations

For ammonium ion:

Action of NaOH:

The salt is warmed with few ml of sodium hydroxide solution.

No characteristic reaction is observed.

Ammonium ion is absent

Group Separation Table

To the original salt solution dil. HCl is added.

No ppt

H₂ gas is passed through the above solution.

I-group

Black ppt is

cation is

formed. May

be copper ions

be copper ions

The original salt solution is saturated with NH₄Cl solid and NH₄OH solution is added in excess.

No ppt

The original solution is saturated with NH₄Cl,

III-group

NH₄OH and (NH₄)₂CO₃. Solutions are added.

cations are

No ppt

Original salt solution is tested

absent

II-group

for Magnesium.

cations are

No ppt is formed.

absent

Magnesium ion is absent.

Confirmation test for cation (Cu²⁺)

a) To the salt solution

NH₄OH solution is added.Pale blue precipitate is formed which is soluble in excess of NH₄OH.

Copper ion is confirmed.

b) To the salt solution

potassium ferrocyanide is added K₄[Fe(CN)₆]

A chocolate coloured ppt is formed.

Copper ion is confirmed.

Report: The given salt contains

Cation: Copper ion (Cu²⁺)Anion: Nitrate ion (NO₃)Given salt: Copper nitrate [Cu(NO₃)₂]

Teacher's Signature _____

Experiment

Ferrous Sulphate

Preliminary Tests :

Observation

Inference

a) Colour

b) State

c) Action of heat : The given salt is taken in a dry test tube, and heated gently and then strongly.

d) Flame test : A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.

Pale green

Crystalline

Water droplets are observed on the walls of test tube.

No characteristic flame is observed.

May be Fe^{+2} .

May be hydrated salt.

 Ca^{+2} , Sr^{+2} , Ba^{+2} , Cu^{+2} , Zn^{+2} are absent

Identification of Anion

1) Action of dil. HCl : To the given salt few ml dil. HCl is added.

2) Action of conc. H_2SO_4 : To the given salt few ml conc. H_2SO_4 is added. And heated if necessary.3) Action of MnO_2 and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . This mixture is treated with conc. H_2SO_4 & heated gently.

No characteristic reaction is observed.

No characteristic reaction is observed.

No characteristic observation

Carbonate, Acetate ions are absent.

Chloride ion, Bromide ion, Iodide ion and Nitrate ion are absent.

 Cl^- , Br^- , I^- are absent

Teacher's Signature _____

g) Action with BaCl₂ solution:

To the salt solution BaCl₂ solution is added.

A white crystalline precipitate is formed. The precipitate is insoluble in conc. HCl.

Sulphate ion is present.

Wet Tests:

Preparation of sodium carbonate extract: A small quantity of the salt is mixed with triple amount of anhydrous sodium carbonate. Distilled water is added, shake well and boiled for about five minutes. It is filtered. The filtrate is known as sodium carbonate extract. The filtrate is tested for Cl⁻, Br⁻, NO₃⁻ and SO₄²⁻ ions.

Confirmatory test for sulphate ion:

Neutralise Na₂CO₃ extract dil. HCl and BaCl₂ solution is added.

A white precipitate (BaSO₄) is formed which is insoluble in conc. HCl.

Sulphate is confirmed.

Identification of cations.

For Ammonium ion:

Action of NaOH: The salt is warmed with few ml of sodium hydroxide solution.

No characteristic reaction is observed.

Ammonium ion is absent.

Group Separation Table

To the original salt solution dil. HCl is added.

No ppt

H₂ gas is passed through the above solution.

I-group cation is

No ppt

The original salt solution is saturated with solid NH₄Cl and

absent

II-group cation is

NH₄OH solution is added in excess.

absent

Dirty green

H₂ gas is passed through the above solution.

absent

ppt is formed

Fe²⁺ is

present

Teacher's Signature _____

Expt. No. _____

No ppt	The original solution is saturated with NH_4Cl , NH_4OH and $(\text{NH}_4)_2\text{CO}_3$ solutions are added.
IV-group cations are absent	No ppt original salt solution is tested for Magnesium.
V-group cations are absent	No ppt is formed. Magnesium ion is absent.

Confirmation test for cation (Fe^{2+})

1) To the salt solution potassium ferrocyanide solution is added.

Pale blue ppt is formed.

Ferrous ion is confirmed.

2) To the salt solution Ammonium hydroxide solution is added.

A dirty green ppt is formed.

Ferrous ion is confirmed.

Report: The given salt contains

Cation: Ferrous ion (Fe^{2+})Anion: Sulphate ion (SO_4^{2-})Given salt: Ferrous sulphate [FeSO_4]

Teacher's Signature _____

Zinc SulphateExperimentPreliminary Tests:

- a) Colour
 b) State
 c) Action of heat: The given salt is taken in a dry test tube and it is first heated gently and then strongly.
 d) Flame test: A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.

Observation

White
 Crystalline
 Water droplets are observed at the walls of test tube.

Green flashes.

Inference

Cu^{2+} , Fe^{3+} , Mn^{2+} are absent

May be hydrated salt.

May be zinc salt.

Identification of Anion

- 1) Action of dil. HCl: To the given salt few ml HCl is added.
 2) Action of conc. H₂SO₄: To the given salt few ml conc. H₂SO₄ is added. And heated if necessary.
 3) Copper Turnings test: To the given salt few copper turnings and few drops of conc. H₂SO₄ are added and heating strongly.

No characteristic reaction is observed.

No characteristic reaction is observed.

No characteristic reaction is observed.

Carbonate, Acetate ions are absent.

Chloride, Bromide and Iodide and Nitrate ions are absent.

Nitrate ion is absent.

Teacher's Signature _____

4) Action of MnO_2 and conc. H_2SO_4 :To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . The mixture is heated with conc. H_2SO_4 and heated gently.

No characteristic observation.

 Cl^- , Br^- , I^- are absent5) Action with $BaCl_2$: The salt solution is added to $BaCl_2$ solution.A white crystalline precipitate is formed. The precipitate is insoluble in conc. HCl .

Sulphate ion is present

Wet Tests :

Preparation of sodium carbonate extract : A small quantity of the salt is mixed with triple amount of anhydrous sodium carbonate. Distilled water is added, shake well and boiled for about five minutes. It is filtered. The filtrate is known as sodium carbonate extract. The filtrate is tested for Cl^- , Br^- , NO_3^- and SO_4^{2-} ions.

Confirmatory tests for sulphate ions :

Neutralise Na_2CO_3 extract with dil. HCl and $BaCl_2$ solution is added.A white precipitate ($BaSO_4$) is formed which is insoluble in conc. HCl .

Sulphate is confirmed.

Identification of cations

For ammonium ion :

Action of $NaOH$:

The salt is warmed with few ml of sodium hydroxide

No characteristic reactions is observed.

Ammonium ion is absent

Teacher's Signature _____

Group separation Table

To the original salt solution dil. HCl is added.

No ppt

Has gas is passed through the above solution.

I-group

No ppt

cation is

II-group

absent

cation is

absent

No ppt

H₂ gas is passed through the above solution.

III-group

white ppt

cations are

-formed

absent

(Zn²⁺)The original solution is saturated with NH₄Cl, NH₄OH and (NH₄)₂CO₃ solutions are added.

IV-group

cation is

present

No ppt

V-group

cations are

absent

Original salt solution is tested for Magnesium. No ppt is formed. Magnesium ion is absent.

Confirmation test for cation (Zn²⁺)

1) To the salt solution NaOH solution is added.

A white ppt turning to brown is formed, which is insoluble in excess of reagent.

Zn²⁺ ion is confirmed.2) To the salt solution K₂[Fe(CN)₆] solution is added.

A greyish white ppt is formed. The ppt is insoluble in dil. HCl and soluble in NaOH solution.

Zn²⁺ ion is confirmed.

Report: The given salt contains

Cation: Zinc ion (Zn²⁺)Anion: Sulphate ion (SO₄²⁻)Given salt: Zinc sulphate [ZnSO₄]

Teacher's Signature _____

Aluminium NitrateExperimentPreliminary Tests:

a) Colour

Observation

White

Inference

 $\text{Cu}^{+2}, \text{Fe}^{+2}, \text{Mn}^{+2}$ are absent

b) State

Crystalline

c) Action of heat:

Reddish brown vapours are evolved.

May be Nitrate

The given salt is taken in a dry test tube and it is first heated gently and then strongly.

d) Flame Test:

No characteristic flame is observed.

 $\text{Cu}^{+2}, \text{Zn}^{+2}, \text{Sr}^{+2}, \text{Ba}^{+2}, \text{Ca}^{+2}$ are absent.

A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.

Identification of Anion

1) Action of dil. HCl: To the given salt few ml HCl is added.

No characteristic reaction is observed.

Carbonate, Acetate ions are absent

2) Action of conc. HNO₃: To the given salt few ml conc. HNO₃ is added. And heated if necessary.

Reddish brown gas (NO₂) is evolved on strong heating.

May be Nitrate ion.

3) Copper Turnings Test: To the given salt few copper turnings and few drops of conc. HNO₃ are added and heating strongly.

Reddish brown gas is evolved. Solution turned to blue.

Nitrate ion is present

Teacher's Signature _____

Expt. No. _____

Date _____

Page No. 42

a) Action of MnO_2 and conc. H_2SO_4 :To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . This mixture is treated with conc. H_2SO_4 and heated gently.

No characteristic reaction is observed.

 Cl^- , Br^- , I^- are absentb) Action with $BaCl_2$: The salt solution is added to $BaCl_2$ solution.

No characteristic reaction is observed.

Sulphate ion is absent

Wet Tests:

Preparation of sodium carbonate extract: A small quantity of the salt is mixed with triple amount of anhydrous sodium carbonate. Distilled water is added, shake well and boiled for about five minutes. It is filtered. The filtrate is known as sodium carbonate extract. The filtrate is tested for Cl^- , Br^- , NO_3^- and SO_4^{2-} ions.

Confirmatory Test for Nitrate ion:

Brown ring Test:

The extract is neutralised with dil. H_2SO_4 an equal of freshly prepared solution of $FeSO_4$ is added and the test tube is kept in an inclined position and conc. H_2SO_4 is added along the inner sides of the test tube.

A brown ring is formed at the junction of two layers.

Nitrate ion is confirmed.

Identification of cations

For ammonium ion:

Action of $NaOH$: The salt is warmed with few ml of $NaOH$.

No characteristic reaction is observed.

Ammonium ion is absent

Teacher's Signature _____

Group Separation Table

To the original salt solution dil. HCl is added.

No ppt

H₂ gas is passed through the above solution.

I-group

No ppt

The original salt solution is saturated with NH₄Cl solid and NH₄OH solution is added in excess.

II-group

No ppt

cations are

absent

H₂ gas is passed through the above solution

No ppt

IV-group

cations are

absent

The original solution is saturated with NH₄Cl, NH₄OH and (NH₄)₂CO₃ solutions are added.

No ppt

III-group

cations are

absent

Original salt solution is tested for Mg. No ppt is formed. Magnesium ion is absent.

Confirmatory tests for cation (Al³⁺)

1) Action of caustic soda (NaOH)

To the salt solution, NaOH solution is added drop by drop.

A white gelatinous precipitate of aluminium hydroxide is formed.

It is soluble in excess of NaOH solⁿ, sodium meta aluminate is formed.

Aluminium ion is confirmed.

2) Action of solid ammonium chloride and ammonium hydroxide.

The salt solution is saturated with solid NH₄Cl. Then NH₄OH is added in the excess.

A white precipitate of aluminium hydroxide is formed. The precipitate is soluble in sodium hydroxide solution. It is insoluble in dilute acids.

Aluminium ion is confirmed.

Report: The given salt contains

Cation: Aluminium ion (Al³⁺)Anion: Nitrate ion (NO₃⁻)Given salt: Aluminium nitrate [Al(NO₃)₃]

Teacher's Signature _____

ExperimentAmmonium AcetatePreliminary Tests:

Observation	Inference
a) Colour	Colourless
b) Physical state	Crystalline
c) Action of heat: A small quantity of salt is heated in a dry test tube, first gently and then strongly.	Colourless gas with smell of NH_3 evolved along with formation of white sublimate inside the test tube.
d) Flame test: A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.	No characteristic flame is observed.

 $\text{Ca}^{+2}, \text{Fe}^{+2}, \text{Mn}^{+2}$ salts are absent

May be ammonium salt

 $\text{Ca}^{+2}, \text{Sr}^{+2}, \text{Ba}^{+2}, \text{Cu}^{+2}, \text{Zn}^{+2}$ are absentIdentification of Anion

1) Action of dil. HCl: To the small quantity of salt few drops of dil. HCl is added.	Gases with vinegar smell are evolved. They turn wet blue litmus paper to red.	May be acetate.
2) Action of conc. H_2SO_4 : To the small quantity of salt few drops of conc. H_2SO_4 is added.	No characteristic reaction is observed.	$\text{Cl}^-, \text{Br}^-, \text{I}^-, \text{NO}_3^-$ are absent
3) Action of MnO_2 and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . This mixture is treated with conc.	No characteristic reaction is observed.	$\text{Cl}^-, \text{Br}^-, \text{I}^-$ are absent

Teacher's Signature _____

Expt. No. _____

Date _____

Page No. 45

Hasy and heated gently.

ii) Action of Baria solution:

To the salt solution Baria solution is added.

No characteristic reaction is observed.

Sulphate (SO_4^{2-}) is absent.

Confirmatory test for acetate ion:

Take a small quantity of the salt in a test tube and add neutral ferric chloride solⁿ.

Deep red coloured solution is formed.

Acetate ion is confirmed.

The above solution is boiled by arranging on a water bath.

Reddish brown precipitate is formed.

Acetate ion is confirmed.

Identification of cation:

Experiment Test for NH_4^+

Observation

Inference

Commonium ion): A small amount of salt is heated with NaOH solution.

Colourless gas with ammonia smell is evolved which gives white dense fumes when a glass rod dipped in conc. HCl is exposed.

May be ammonium (NH_4^+) ion.

Preparation of original solution:

The solution prepared by dissolving the given salt in a suitable solvent in which it is soluble. It is prepared for identification of cations.

Group Separation Table

To the original salt solution dil. HCl is added.

No ppt

Has gas is passed through the above solution.

I-group

No ppt

The original salt solution is saturated with solid NH_4Cl and NH_4OH solution is added in excess.

cation is

II-group

absent

cation is

absent

No ppt

Has gas is passed through the above solution.

III-group

cation is

absent

Teacher's Signature _____

No ppt	The original salt solution is saturated with NH_4Cl , NH_4OH and $(\text{NH}_4)_2\text{CO}_3$ solutions are added.	
IV-group cation is absent	No ppt	Original salt solution, is tested for Magnesium.
	V-group cation is absent	No ppt is formed.
		Magnesium ion is absent

Confirmatory test for cation (NH_4^+)

Experiment	Observation	Inference
a) To the salt, NaOH solution is added and boiled.	A colourless gas with ammonia smell is evolved which gives white dense fumes when a glass rod dipped in conc. HCl is exposed.	Ammonium ion is confirmed.
b) To the salt solution Nessler's reagent (K_2HgI_4) is added.	Reddish brown precipitate is formed.	Ammonium ion is confirmed.

Report: The given salt contains

Cation: Ammonium ion (NH_4^+)Anion: Acetate ion (CH_3COO^-)Given salt: Ammonium acetate ($\text{CH}_3\text{COONH}_4$)

Teacher's Signature _____

Barium AcetateExperimentPreliminary Tests:ObservationInference

a) Colour

Colourless

 Cu^{+2} , Fe^{+3} , Mn^{+2} are absent

b) State

Crystalline

c) Action of heat: The given salt is taken in a dry test tube, heated gently and then strongly.

Water droplets are formed on the walls of the test tube.

May be hydrated salt.

d) Flame test: A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.

Grassy green flame.

May be Barium salt.

Identification of -Anion

1) Action of dil. HCl: To the given salt few ml dil. HCl are added.

Gases with vinegar smell are evolved. They turn wet blue litmus paper to red.

May be acetate

2) Action of conc. H₂SO₄: To the given salt few ml conc. H₂SO₄ is added. And heated if necessary.

No characteristic reaction is observed.

 Cl^- , Br^- , I^- , NO_3^- are absent3) Action of MnO₂ and conc. H₂SO₄: To the small quantity of salt is taken in a test tube and add a pinch of MnO₂. This mixture is treated with conc. H₂SO₄

No characteristic reaction is observed.

 Cl^- , Br^- , I^- are absent

Teacher's Signature _____

Expt. No. _____

Date _____

Page No. 118

and heated gently.

4) Action with BaCl_2 solution:To the salt solution, BaCl_2 solution is added.

No characteristic reaction is observed.

sulphate (SO_4^{2-}) is absent.Confirmatory Test for Acetate ion

Take a small quantity of the salt in a test tube and add neutral ferric chloride solution.

Deep red coloured solution is formed.

Acetate ion is confirmed.

The above solution is boiled by arranging on a water bath.

Reddish brown precipitate is formed.

Acetate ion is confirmed.

Identification of Cation

For ammonium ion:

No characteristic reaction is observed.

Ammonium ion is absent.

Action of NaOH solution:The salt is warmed with few ml of solution hydroxide solⁿ.Group Separation Table

To the original salt solution dil-HCl is added.

No ppt

Has gas is passed through the above solution.

I-group

No ppt

cation is

II-group

absent

cation is

absent

No ppt

III-group

cation is

absent

Has gas is passed through the above solution

No ppt

IV-group

cations are

absent

The original solution is saturated with NH_4Cl , NH_4OH and $(\text{NH}_4)_2\text{CO}_3$ solutions are added

Teacher's Signature _____

White ppt is
formed may
be barium
ion (or)
calcium ion

Original salt solution is tested for Magnesium.
No ppt is formed. Magnesium ion is absent.

Confirmation tests for cation (Ba^{2+})

1) To the salt solution potassium
chromate (K_2CrO_4) solution
is added.

Yellow ppt is formed, which
is soluble in conc. HCl.

Barium ion is confirmed.

2) To the salt solution ammonium
oxalate [$(NH_4)_2C_2O_4$] solution
is added.

White precipitate is formed.
It is soluble in acetic acid.

Barium ion is confirmed.

Report: The given salt contains

Cation: Barium ion (Ba^{2+})

Anion: Acetate ion (CH_3COO^-)

Given salt: Barium acetate [CH_3COO_2Ba]

Teacher's Signature _____

Barium chlorideExperimentPreliminary Tests:

a) Colour

Observation

Colourless

Inference

 Cu^{2+} , Fe^{3+} , Mn^{2+} are absent

b) State

Crystalline

c) Action of heat: The given salt is taken in a dry test tube, heated gently and then strongly.

Water droplets are formed on the walls of the test tube.

May be hydrated salt.

d) Flame test: A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.

Grassy Green Flame

May be Barium salt.

Identification of Anion

1) Action of dil. HCl: To the given salt few ml dil. HCl is added.

No characteristic reaction is observed.

Carbonate, Acetate ions are absent.

2) Action of conc. H₂SO₄: To the given salt few ml of conc. H₂SO₄ is added. And heated if necessary.Colourless gas with pungent smell is evolved. It fumes in moist air and gives white dense fumes with a glass rod dipped in NH₄OH solution.

May be chloride ion.

3) Action of MnO₂ and conc. H₂SO₄: To the small quantity of salt is taken in a test tube and add a pinch of MnO₂. This mixture is treated with conc. H₂SO₄ and heated gently.

Greenish Yellow coloured gas is evolved.

May be chlorate ion.

Teacher's Signature _____

c) Action with BaCl_2 solution:
To the salt solution BaCl_2 solution is added.

its characteristic reaction is observed.

sulphate ion is absent

Wet Tests:

Preparation of Sodium carbonate extract : A small quantity of the salt is mixed with triple amount of anhydrous sodium carbonate. Distilled water is added, shake well and boiled for about five minutes. It is filtered. The filtrate is known as sodium carbonate extract. The filtrate is tested for Cl^- , Br^- , NO_3^- and SO_4^{2-} ions.

Confirmatory Test for Chloride:

Neutralise Na_2CO_3 extract
with dil. HNO_3 and AgNO_3
solution is added.

A crudy white precipitate (ppt) is formed. The ppt is completely soluble in NH_4OH solution.

Chloride is confirmed.

Identification of cation

For ammonium ion:

No characteristic reaction is observed.

-Ammonium ion is absent

Action of NaOH solution:

The salt is warmed with
few ml of sodium hydroxide
solution

Group Separation Table

To the original salt solution dil. HCl is added:

No ppt. H_2S test is passed through the above solution

I-group cation is	No ppt	The original salt solution is saturated with NH_4Cl solid and pH solution is added in excess.
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absent	cation is	No ppt	Has gas is passed through the above solution.
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absent	II-group	No ppt	The original solution is saturated
	cation is	IV-group	with NH_4Cl , NH_4OH and
	absent	cations are	$(\text{NH}_4)_2\text{CO}_3$. Solutions are added

White ppt
is formed
may be
barium ion
or calcium
ion

Original salt solution is tested for Magnesium.
No ppt is formed. Magnesium ion is absent

Confirmation tests for cation (Ba^{2+})

1) To the salt solution
potassium chromate ($\text{K}_2\text{Cr}_2\text{O}_7$)
solution is added.

Yellow ppt is formed, which
is soluble in conc. HCl

Barium ion is confirmed.

2) To the salt solution
ammonium oxalate
 $(\text{NH}_4)_2\text{C}_2\text{O}_4$ solution is
added.

White precipitate is formed.
It is soluble in acetic acid

Barium ion is confirmed.

Report: The given salt contains

Cation: Barium ion (Ba^{2+})

Anion: Chloride ion (Cl^-)

Given salt: Barium chloride [BaCl_2]

Teacher's Signature _____

Lead NitrateExperimentPreliminary Tests:

a) Colour

Observation

Inference

b) State

Colourless

 Ca^{2+} , Fe^{3+} , Mn^{2+} are absent

c) Action of heat: The given salt is taken in a dry test tube and it is first heated gently and then strongly.

Crystalline
Water droplets are observed at the walls of test tube.

May be, Hydrated salt.

d) Flame Test: A small quantity of salt is made into paste on a watch glass with conc. HCl and introduced on flame with a platinum loop.

No characteristic flame is observed.

 Ca^{2+} , Sr^{2+} , Ba^{2+} , Cu^{2+} , Zn^{2+} are absentIdentification of Anion

1) Action of dil. HCl: To the given salt few ml. dil. HCl is added.

No characteristic reaction is observed.

Carbonate, Acetate ions are absent

2) Action of conc. H_2SO_4 : To the given salt few ml. conc. H_2SO_4 is added. And heated if necessary.Reddish brown gas (NO_2) is evolved on strong heating.

May be Nitrate ion

3) Action of MnO_2 and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube and add a pinch of MnO_2 . This mixture is treated with conc. H_2SO_4 and heated gently.

No characteristic reaction is observed.

 Cl^- , Br^- , I^- are absent.

Teacher's Signature _____

Date _____

Page No. 54

Expt. No. _____

ii) Action with BaCl_2 : To the salt solution BaCl_2 solution is added.	No characteristic reaction is observed.	Sulphate ion is absent.
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Wet Tests:

Preparation of sodium carbonate extract: A small quantity of the salt is mixed with triple amount of anhydrous sodium carbonate. Distilled water is added, shake well and boiled for about five minutes. It is filtered. The filtrate is known as sodium carbonate extract. The filtrate is tested for Cl^- , Ba^{2+} , NO_3^- and SO_4^{2-} ions.

Confirmatory test for Nitrate:

Brown-ring Test:	A brown ring is formed at the junction of aqueous and acid layers.	Nitrate is confirmed.
Neutralize Na_2CO_3 extract with dil. H_2SO_4 . Freshly prepared FeSO_4 solution is added. The test tube is kept in an inclined position and conc. H_2SO_4 is added slowly along the inner side of test tube without disturbing the solution.		

Identification of cations

For ammonium ion:	No characteristic reaction is observed.	Ammonium ion is absent.
Action of NaOH : The salt is warmed with few ml of solution i.e. sodium hydroxide solution.		

Teacher's Signature _____

Group Separation Table

To the original salt solution dil. HCl is added.

white ppt is formed.	H ₂ gas is passed through the above solution.	No ppt	The original salt solution is saturated with NH ₄ Cl solid and
May be lead	II-group cation is absent	No ppt	and NH ₄ OH solution is added in excess.
	III-group cations are absent	No ppt	H ₂ S gas is passed through the above solution.
		No ppt	The original solution is saturated with NH ₄ Cl, NH ₄ OH and (NH ₄) ₂ CO ₃ solutions are added.
		No ppt	Original salt solution is tested for
		No ppt	V-group cations are Magnesium. No ppt
		No ppt	is formed. Mg ion
		No ppt	is absent.

Confirmation test for cation (Pb²⁺)

1) To the salt: potassium chromate (K ₂ CrO ₄) solution is added.	Yellow ppt is formed which is soluble in dil. HNO ₃ and insoluble in acetic acid.	Lead ion is confirmed.
2) To the salt solution potassium iodide (KI) solution is added.	Yellow ppt is formed. The precipitate is soluble in hot water. On cooling the colourless solution, golden yellow spangles of lead iodide separated.	Lead ion is confirmed.

Report: The given salt contains

Cation: Lead ion (Pb²⁺)Anion: Nitrate ion (NO₃⁻)Given salt: Lead nitrate [Pb(NO₃)₂]

Teacher's Signature _____

Calcium Nitrate [$\text{Ca}(\text{NO}_3)_2$]

Preliminary Test :

a) Colour : White, (Cu^{2+} , Fe^{3+} & Mn^{2+} cations may be absent.)

b) State : Crystalline

Experiment	Observation	Inference
c) Solubility : Take a small amount of salt in a dry and fresh test tube, add small amount of distilled water.	Soluble in water.	Water soluble salt.
d) Flame test : Clean the platinum wire by dipping in conc. HCl and heat it on flame upto no colour appears. Now, prepare the paste of conc. HCl + salt in watch glass, then introduce this paste by platinum wire loop into the flame.	Brick red	Ca^{2+} may be present.
e) Action of heat : A small quantity of salt is taken in a dry test tube and strongly heated.	Reddish Brown vapours are evolved.	May be Nitrate (NO_3^-) salt is present.

Identification of Anion

f) Action of dil. HCl : A small quantity of salt is taken in a dry test tube, and strongly heated.	No reaction.	May be Nitrate (NO_3^-) salt is present.
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Teacher's Signature _____

a) Action of conc. H_2SO_4 : A small quantity of salt is taken in a dry test tube and conc. H_2SO_4 is added.

a. Before heating no reaction
b. After heating reddish brown vapours are evolved.

Nitrate (NO_3) ion may be present

Confirmation Tests for Nitrate ion

1) Action of Cu turnings and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube. 1 cm 2 piece of Cu turnings and conc. H_2SO_4 are added then heated.

Reddish Brown vapours of NO_2 are evolved and the solution turns pale blue.

Nitrate (NO_3) ion is confirmed.

2) Brown-ring test : A small quantity of salt solution is taken in a test tube and same amount of freshly prepared FeSO_4 solution is added, then few drops of conc. H_2SO_4 is added by keeping the test tube in an inclined position.

Dark brown ring is formed in between the junction of two layers.
(Nitroso ferrous sulphate)
($\text{FeSO}_4 \cdot \text{NO}$)

Nitrate (NO_3) ion is confirmed.

Identification of cation

Experiment
1) Tests for ammonium ion : To the small quantity of salt is taken in a

Observation
Colourless gas (NH_3) with pungent smell is not evolved.

Inference
Ammonium (NH_4^+) cation is absent

Teacher's Signature _____

a) Test for I-group cations: To the salt solution a few drops of dil. HCl solution is added.	No ppt. is formed.	Lead (Pb^{2+}) cation is absent.
b) Test for II-group cations: To the salt solution a few drops of dil. HCl solution is added and H ₂ S gas is passed.	No ppt. is formed.	Copper (Cu^{2+}) cation is absent.
c) Test for III-group cations: To the salt solution NH_4Cl salt and NH_4OH sol ⁿ are added.	No ppt. is formed.	Aluminium (Al^{3+}) and Ferric (Fe^{3+}) cations are absent.
d) Test for IV-group cations: To the salt solution, NH_4Cl salt and NH_4OH sol ⁿ are added, then H ₂ S gas is passed.	No ppt. is formed.	Zinc (Zn^{2+}), Manganese (Mn^{2+}), Nickel (Ni^{2+}) cations are absent.
e) Test for V-group cations: To the salt solution, NH_4Cl salt is added, then NH_4OH and $(NH_4)_2CO_3$ solutions are added.	White ppt. is formed.	Barium (Ba^{2+}) or Calcium (Ca^{2+}) or Strontium (Str^{2+}) cation may be present.

Confirmation Tests for Calcium

1) Action of K_2CrO_4 solution: To the salt sol ⁿ potassium chromate sol ⁿ (K_2CrO_4) is added.	Yellow colour ppt. ($CaCrO_4$) is not formed (yellow colour solution is formed).	Calcium (Ca^{2+}) cation is confirmed.
2) Action of Ammonium oxalate sol ⁿ : To the salt solution Ammonium oxalate sol ⁿ is added.	White colour ppt. (CaC_2O_4) is formed. Above ppt. is insoluble in hot acetic acid.	Calcium (Ca^{2+}) cation is confirmed.

Report: The given cation is: Calcium (Ca^{2+})

The given anion is: Nitrate (NO_3^-)

The given salt is: Calcium Nitrate [$Ca(NO_3)_2$]

Teacher's Signature _____

Copper SulphatePreliminary Test :

- a) Colour : Blue. (May be Cu^{2+} cation is present.)
 b) State : Crystalline.

Experiment	Observation	Inference
c) Solubility : Take a small amount of salt in a dry and fresh test tube, add small amount of distilled water.	Soluble in water.	Water soluble salt.
d) Flame test : Clean the platinum wire by dipping in conc. HCl and heat it on flame upto no colour appears.	Bright bluish-green	Cu^{2+} may be present.
e) Action of heat : A small quantity of salt is taken in a dry test tube and strongly heated.	Water droplets are formed on the inner walls of test tube.	May be hydrated salt.

Identification of Anion

1) Action of dil. HCl : A small quantity of salt is taken in a dry test tube, dil. HCl is added.	No reaction	Carbonate (CO_3^{2-}) and Acetate (CH_3COO^-) ions are absent.
2) Action of conc. H_2SO_4 : A small quantity of salt is taken in a dry test tube and conc. H_2SO_4 is added.	a. Before heating no reaction. b. After heating no reaction.	Chloride (Cl^-) & Bromide (Br^-) ions are absent. Nitrate (NO_3^-) ion is absent.
3) Action of Cu turnings and conc. H_2SO_4 : To the small quantity of salt is taken in a	No reaction.	Nitrate (NO_3^-) ion is present.

Teacher's Signature _____

test tube 1 as a piece of Cu turnings and conc. H_2SO_4 are added and then heated.

4) Action of $BaCl_2$ solution: To the salt solution $BaCl_2$ solution is added.

White ppt. of $(BaSO_4)$ is formed.

Sulphate (SO_4^{2-}) ion is present.

Confirmation tests for sulphate ion

Action of $BaCl_2$ solution: To the salt solution $BaCl_2$ solution is added.

White ppt. of $(BaSO_4)$ is formed.
Solubility: Above ppt. is insoluble in conc. HCl .

Sulphate (SO_4^{2-}) ion is confirmed.

Identification of cation

Experiment

Observation

Inference

1) Test for ammonium (NH_4^+) ion: To the small quantity of salt is taken in a dry test tube a few drops of $NaOH$ solution is added and strongly heated.

Colourless gas (NH_3) with pungent smell is not evolved.

Ammonium (NH_4^+) cation is absent.

2) Test for I-group cations: To the salt solution a few drops of dil. HCl solution is added.

No ppt. is formed.

Lead (Pb^{2+}) cation is absent.

3) Test for II-group cations: To the salt solution a few drops of dil. HCl soln is added and H_2S gas is passed.

Black colour ppt. is formed $[Cu(OH)_2]$

Copper (Cu^{2+}) cation is absent.

Teacher's Signature _____

Confirmation Tests for Copper

1) Action of NaOH solution: To the salt solution NaOH solution is added.	Blue colour ppt. is formed [Cu(OH) ₂]	Copper (Cu ²⁺) cation is confirmed.
2) Action of K ₄ [Fe(CN) ₆] solution: To the salt soln potassium ferrocyanide solution is added.	Chocolate colour ppt. is formed Cu ₂ [Fe(CN) ₆] which is insoluble in dil. HCl.	Copper (Cu ²⁺) cation is confirmed.

Report: The given cation is: Copper (Cu²⁺)

The given anion is: Sulphate (SO₄²⁻)

The given salt is: Copper sulphate [CuSO₄]

Teacher's Signature _____

Nickel NitratePreliminary Test:

- a) Colour: Greenish (Ni^{2+} cation may be present)
 b) State: Crystalline

Experiment

Experiment	Observation	Inference
c) Solubility: Take a small amount of salt in dry and fresh test tube, add small amount of distilled water.	Soluble in water.	Water soluble salt.
d) Flame test: Clean the platinum wire by dipping in conc. HCl and heat it on flame upto no colour appears. Now, prepare the paste of conc. HCl + salt in watch glass, then introduce this paste by platinum wire loop into the flame.	No colour observed.	Ca^{2+} , Sr^{2+} , Ba^{2+} , Cu^{2+} , Zn^{2+} (or) Mn^{2+} , Pb^{2+} are absent
e) Action of heat: A small quantity of salt is taken in a dry test tube, and strongly heated.	Reddish Brown vapours are evolved.	May be nitrate (NO_3^-) salt is present.

Identification of Anion

1) Anion of dil. HCl: A small quantity of salt is taken in a dry test tube, and dil. HCl is added.	No reaction	Carbonate (CO_3^{2-}) and acetate (CH_3COO^-) ions are absent
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Teacher's Signature _____

a) Action of conc. H_2SO_4 : A small quantity of salt is taken in a dry test tube and conc. H_2SO_4 is added.

a. Before heating no reaction
b. After heating Reddish brown vapours are evolved.

Chloride (Cl^-) & Bromide (Br^-) ions are absent.
Nitrate (NO_3^-) ion may be present

Confirmation Tests for nitrate ion

i) Action of Cu turnings and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube 1 or 2 pieces of Cu turnings and conc. H_2SO_4 are added and then heated.

Reddish Brown vapour of NO_2 are evolved and the solution turns plane blue.

Nitrate (NO_3^-) ion is present

ii) Brown-Ring test: A small quantity of salt solution is taken in a test tube and same amount of freshly prepared $FeSO_4$ solution is added, then few drops of conc. H_2SO_4 is added by keeping the test tube in an inclined position.

Dark brown ring is formed in between the junction of two layers (Nitroso ferrous sulphate) ($FeSO_4 \cdot NO$).

Nitrate (NO_3^-) ion is confirmed.

Identification of cation

Experiment

Observation

Inference

1. Test for ammonium ion: To the small quantity of salt is taken in a dry test tube a few drops of $NaOH$ solution is added and strongly heated.

Colourless gas (NH_3) with pungent smell is not evolved.

Ammonium (NH_4^+) cation is absent.

Teacher's Signature

2) Test for I-group cations: To the salt solution a few drops of dil. HCl solution is added.	No ppt is formed.	Lead (Pb^{2+}) cation is absent.
3) Test for II-group cations: To the salt solution a few drops of dil. HCl solution is added and H ₂ S gas is passed.	No ppt is formed.	Copper (Cu^{2+}) cation is absent.
4) Test for III-group cations: To the salt solution NH_4Cl salt and NH_4OH solution are added.	No ppt is formed.	Aluminium (Al^{3+}) & Ferric (Fe^{3+}) cations are absent.
5) Test for IV-group cations: To the salt solution NH_4Cl salt and NH_4OH solution are added, then H ₂ S gas is passed.	Black ppt (NiS) is formed.	Nickel (Ni^{2+}) cation may be present.

Confirmation tests for Nickel

1) Action of NaOH solution: To the salt solution sodium hydroxide solution is added.	Green gelatinous ppt ($Ni(OH)_2$) is formed. It is insoluble in excess of NaOH solution.	Nickel (Ni^{2+}) cation is confirmed.
2) Action of NaOH solution: To the salt solution NH_4OH solution is added.	Green ppt $Ni(OH)_2$ is formed. It becomes blue violet on addition of excess of NH_4OH solution.	Nickel (Ni^{2+}) cation is confirmed.

Report:

The given cation is: Nickel (Ni^{2+})

The given anion is: Nitrate (NO_3^-)

The given salt is: Nickel nitrate [$Ni(NO_3)_2$]

Teacher's Signature _____

Manganese SulphatePreliminary Test:

- a) Colour: Pale Pink. (Mn^{2+} cation may be present)
- b) State: Crystalline

Experiment

Experiment	Observation	Inference
c) Solubility: Take a small amount of salt in dry and fresh test tube, add small amount of distilled water.	Soluble in water.	Water soluble salt
d) Flame test: Clean the platinum wire by dipping in conc. HCl and heat it on flame upto no colour appears. Now, prepare the paste of conc. HCl + salt in watch glass, then introduce this paste by platinum wire deep into the flame.	Green flashes	Zn^{2+} or Mn^{2+} may be present.
e) Action of heat: A small quantity of salt is taken in a dry test tube and strongly heated.	Water droplets are formed on the inner walls of test tube.	May be Hydrated salt.

Identification of Anions.

i) Action of dil. HCl: A small quantity of salt is taken in a dry test tube, and dil. HCl is added.	No reaction	Carbonate (CO_3^{2-}) and acetate (CH_3COO^-) ions are absent.
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Teacher's Signature _____

2) Action of conc. H_2SO_4 : A small quantity of salt is taken in a dry test tube and conc. H_2SO_4 is added.

- a. Before heating no reaction.
b. After heating no reaction.

Chloride (Cl^-) & Bromide (Br^-) ions are absent.

3) Action of Cu turnings and conc. H_2SO_4 : To the small quantity of salt is taken in a test tube, 1 or 2 pieces of Cu turnings and conc. H_2SO_4 are added and then heated.

No reaction.

Nitrate (NO_3^-) ion is absent.

4) Action of $BaCl_2$ solution: To the salt solution $BaCl_2$ solution is added.

White ppt. of $(BaSO_4)$ is formed.

Sulphate (SO_4^{2-}) ion is present.

Confirmation test for sulphate ion

Action of $BaCl_2$ solution: To the salt solution $BaCl_2$ solution is added.

White ppt. of $(BaSO_4)$ is formed.

Sulphate, (SO_4^{2-}) ion is confirmed.

Solubility: above ppt is insoluble in conc. HCl .

Identification of cation

Experiment

Observation

Inference

1) Test for ammonium ion: To the small quantity of salt is taken in a dry test tube, a few drops of $NaOH$ solution is added and strongly heated.

Colourless gas (NH_3) with pungent smell is not evolved.

Ammonium (NH_4^+) cation is absent.

2) Test for I-group cations: To the salt solution a few drops of dil. HCl solⁿ is added.

No ppt is formed.

Lead (Pb^{2+}) cation is absent.

Teacher's Signature _____

3) Test for II-group cations:

To the salt solution a few drops of dil. HCl solution is added and H_2S gas is passed.

No ppt is formed.

Copper (Cu^{2+}) cation is absent.

4) Test for III-group cations:

To the salt solution NH_4Cl salt and NH_4OH solution are added.

No ppt is formed.

Aluminium (Al^{3+}) and ferric (Fe^{3+}) cations are absent.

5) Test for IV-group cations:

To the salt solution NH_4Cl salt and NH_4OH solution are added, then H_2S gas is passed.

Flesh colour ppt (MnS) is formed.

Manganese (Mn^{2+}) cation may be present.

Confirmation Test for Manganese

1) Action of NaOH solution:

To the salt solution sodium hydroxide solution ($NaOH$) is added.

White ppt $Mn(OH)_2$ is formed which turns to brown colour. It is insoluble in excess of $NaOH$ solution.

Manganese (Mn^{2+}) cation is confirmed.

2) Action of NH_4OH solution:

To the salt solution NH_4OH solution is added.

White ppt $Mn(OH)_2$ is formed which is soluble in excess of NH_4OH solution.

Manganese (Mn^{2+}) cation is confirmed.

Report:

The given cation is: Manganese (Mn^{2+})

The given anion is: Sulphate (SO_4^{2-})

The given salt is: Manganese sulphate ($MnSO_4$)

Teacher's Signature _____

1. Ethyl Alcohol

S.No	Experiment	Observation	Inference
1.	Physical state	Liquid	—
2.	Ignition test : Take a small amount of the given compound in Nickel spatula and ignite on the Bunsen flame.	Non-sooty flame	Aliphatic
3.	Stability	soluble in water, ether	—
4.	Identification and confirmatory tests :		
	(a) Esterification Test : Take a little amount of given compound in a test tube, add 1 ml of acetic acid and few drops of conc. H ₂ SO ₄ . Now, heat the test tube and pour the hot contents in the water in a beaker	Fruity odour is observed.	May be Alcohol.
	(b) Iodoform test : Take 1 ml of the compound in a test tube and add 1 ml of 1% iodine solution then add dil. NaOH solution drop wise until the brown colour is discharged, warm gently on a water bath.	Yellow crystals are formed.	Alcohol is confirmed.

Report: The given organic compound is ethyl alcohol

Teacher's Signature

2. Acetic acid

S.No	Experiment	Observation	Inference
1.	Physical state		
2.	Ignition Test: Take a small amount of the given compound in a Nickel spatula and Ignite on the Bunsen flame.	liquid Non-sooty flame.	— Aliphatic
3.	Solubility		
		Soluble in water, NaOH	
4.	Identification and confirmatory test: (a) Esterification test: Take a little amount of given compound in a test tube, add 1ml of ethyl alcohol and few drops of conc. H ₂ SO ₄ . Heat the contents and pour into water in a beaker.	Fruity odour is observed.	Carboxylic acid is confirmed.
	(b) Test with neutral ferric chloride: Add few drops of neutral ferric chloride solution to 1ml of solution of given compound.	winish red coloured solution is formed. Fruity odour is observed.	May be carboxylic acid

Report: The given organic compound is acetic acid

3. Benzoic Acid

S.No	Experiment	Observations	Inference
1.	Physical state		
2.	Ignition Test: Take a small amount of the given compound in a Nickel spatula and ignite on the Bunsen flame.	Solid Sooty flame	— Aromatic
3.	Solubility		
		Soluble in hot water, ether	
4.	Identification and Confirmation Test: (a) Test with Neutral ferric chloride: Add few drops of neutral ferric chloride solution to 1ml of solution of given compound.	Violet colour solution (ppt is formed).	May be carboxylic acid
	(b) Esterification Test: To small amount of compound (or) to its solution add 1 ml of ethyl alcohol and few drops of conc. H ₂ SO ₄ . Heat the contents and pour into water in a beaker.	Fruity odour is observed	Carboxylic acid is confirmed.

Report: The given organic compound is benzoic acid

Teacher's Signature _____

4. Acetaldehyde

S.No	Experiment	Observation	Inference
1.	Physical state	Liquid	-
2.	<u>Ignition state:</u> Take a small amount of the given compound in a Nidseel spatula and Ignite on Bunsen flame	Non-sooty flame	Aliphatic
3.	Solubility	Soluble in ether, alcohol.	
4.	<u>Identification and Confirmation Test:</u> (a) <u>Test with 2,4 DNP:</u> To a small amount of solution of compound add few drops of 2,4-Dinitro Phenyl Hydrazine reagent.	Orange precipitate is formed.	May be Aldehyde.
	(b) <u>Test with Schiff's reagent:</u> To a small amount of solution of compound and few drops of Schiff's reagent.	Pink colour is formed.	Aldehyde is confirmed.

Report: The given organic compound is acetaldehyde

Teacher's Signature _____

5. Phenol

S.No	Experiment	Observation	Inference
1.	Physical state	Liquid (semisolid)	—
2.	<u>Ignition Test:</u> Take a small amount of given compound in Nickel spatula and ignite on Bunsen flame	sooty flame	Aromatic
3.	<u>Solubility</u>	Soluble in NaOH, ether	
4.	<u>Identification and Confirmation Test:</u> (a) <u>Test with neutral ferric chloride:</u> To a small amount of given compound add few drops of neutral ferric chloride	Violet colour solution is formed	May be phenol
	(b) <u>Liebermann's Test:</u> To a small amount of given compound add few crystals of NaNO_2 and excess of conc. H_2SO_4 . To above blue coloured solution add water slowly. Again add NaOH solution to above red coloured solution.	At first blue coloured solution is formed. solution turns to red. Blue colour solution is reformed.	Phenol is confirmed.

Report: The given organic compound is phenol

Teacher's Signature _____

6. Aniline

S.No	Experiment	Observation	Inference
1.	Physical state	liquid	-
2.	<u>Ignition Test</u> : Take a small amount of the given compound in a Nickel spatula and Ignite on the Bunsen flame.	Sooty flame	Aromatic
3.	Solubility	Soluble in ether, HCl	
4.	(a) <u>Azo-dye Test</u> : To a little amount of given compound, add HCl and cool by keeping in a beaker containing ice pieces. To this cold solution, add few drops of cooled β -Naphthol solution and 100% NaOH solution.		
	(b) <u>Carbylamine Test</u> : To a little amount of given compound in a test tube and add few drops of chloroform and alcoholic NaOH solution heat test tube for about 1-minute	Pungent - smelling gases with foul odour are evolved.	Amine is confirmed.

Report: The given organic compound is aniline

Teacher's Signature _____

7. Benzaldehyde

S.No	Experiment	Observation	Inference
1.	Physical state	Liquid	—
2.	<u>Ignition Test</u> : Take a small amount of the given compound in a Nickel spatula and ignite on the Bunsen flame.	Sooty flame	Aromatic
3.	Solubility	Soluble in ether, alcohol.	
4.	<u>Identification & Confirmation Test</u> : (a) <u>Test with 2,4-DNP</u> : Dissolve a small amount of given compound in ethanol and add few drops of 2,4-DNP.	Orange ppt is formed.	may be aldehyde or Ketone.
	(b) <u>Test with Schiff's reagent</u> : To a small amount of given compound 1ml of Schiff's reagent is added.	Pink colour is reformed	Aldehyde is confirmed.

Report: The given organic compound is benzaldehyde.

Teacher's Signature _____

8. Acetone

S.No	Experiment	Observation	Inference
1.	Physical state	Liquid	-
2.	<u>Ignition Test:</u> Take a small amount of given compound in a Nickel spatula and ignite on Bunsen flame.	Non-sooty flame.	Aliphatic
3.	Solubility	Soluble in hot water, ether.	
4.	<u>Identification and Confirmation Test:</u> (a) <u>Test with 2,4-DNP:</u> To a small amount of given compound few drops of 2,4-DNP is added.	Orange coloured ppt is formed.	
	(b) <u>Test with Schiff's reagent:</u> To a small amount of given compound add few drops of Schiff's reagent is added.	Pink colour is not regenerated.	Ketone is confirmed.

Report: The given organic compound is acetone.

Teacher's Signature _____

1. Preparation of lyophilic solution - starch.

Aim: To prepare the colloidal solution of lyophilic solution of starch.

Apparatus: Beaker, 250ml, glass rod, 50ml funnel, filter paper, pistol, mortar, tripod stand, wire gauge.

Chemicals: 500mg of soluble starch

Procedure:

1. Take 500mg of starch in mortar and add a few drops of distilled water.
2. Grind the starch to make a thin paste and transfer this paste into a 50ml beaker.
3. Take 100ml of water in 250ml beaker and heat until water starts boiling.
4. Pour the paste slowly with stirring into a boiling water in beaker.
5. Continue boiling for about 10 minutes and then cool the beaker.
6. Filter the contents of the beaker through a filter paper fixed into a funnel label and filtrate as "starch" solution.

Teacher's Signature _____

2. Preparation of lyophilic solution - Egg Albumin.

Aim: To prepare colloidal solution of lyophilic solution of egg albumin.

Apparatus: Beaker 250ml, 50ml glass rod, funnel, filter paper, plate and mortar, tripod stand, burner.

Chemicals: An egg, sodium chloride, and distilled water.

Procedure:

1. Breaks out shell of egg by striking it with a glass rod and collect its colourless liquid along with yellow, yolk, decant the colourless liquid into another beaker. This colourless liquid is called egg Albumin.
2. Prepare 100ml of 5% (w/v) solution of sodium chloride in a 250ml beaker. To this solution add egg albumin in small portion with constant stirring. This process should taken 15-20 minutes.
3. Filter the contents of beaker through a filter paper fixed in a funnel and collect the filtrate label this filtrate a "egg - albumin" solution.

Teacher's Signature _____

3. Preparation of lyophobic solution - Gum :

Aim: To prepare colloidal solution of lyophobic solution of gum.

Apparatus: Beaker 250ml, 50ml glass rod, funnel, filter paper, plate and mortar, glass, tripod stand and burner.

Chemicals: 500mg of soluble gum and distilled water.

Procedure :

1. Take 500mg of gum in mortar and add a few drops of distilled water.
2. Mix the gum to make a thin paste and transfer thin paste into a 500ml beaker.
3. Take 100ml of water in a 250ml beaker and heat gently.
4. Pour the paste slowly with stirring into and boiling water in feature.
5. Continue boiling for about 10 min and then cool the beaker.

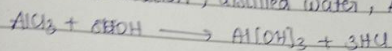
Teacher's Signature _____

4. Preparation of lyophobic solution - Aluminium hydroxide.

Aim: To prepare colloidal solution of lyophobic solution of $[Al(OH)_3]$.

Apparatus: Conical flask - 250ml, boiling tube, tripod stand, funnel, wire gauge, iron stand, parchment paper, glass rod, test tube and dropper.

Chemicals: 2% $AlCl_3$ solution, distilled water, $AgNO_3$ solution.



Procedure:

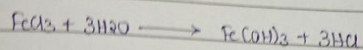
1. Take a 250ml of conical flask, and clean it by streaming.
2. To this conical flask, add 100ml of distilled water and heat it to boil by placing the flask on a wire gauge.
3. Add Aluminium chloride solution drop wise to boiling water.
4. Continue heating until deep red (or) brown solution of aluminium hydroxide is obtained. ~~replaced the water just by vapouration hydroxide~~
5. Keep contents of conical flask undisturbed for sometime at warm temperature. Label the solution as aluminium hydroxide solution.

5. Preparation of lyophobic solution : ferric hydroxide.

Aim : To prepare colloidal solution of lyophobic solution of ferric hydroxide solution.

Apparatus : Beaker 250ml, conical flask, 250ml, a boiling tube, glass rod, funnel, round bottom flask, iron stand, tripod stand and burette.

Chemicals : 2% solution of ferric chloride prepared by dissolving 2g of FeCl_3 in 100ml of distilled water.



Procedure :

1. Take a 250ml conical flask and clean it by steaming.
2. To this cleaned flask add 100ml of distilled water and heat it to boiling by placing the flask on a wire-gauge.
3. Add ferric chloride drop wise of boiling water.
4. Continue heating until deep red or brown solution of ferric hydroxide is obtained. Replace the water just by evaporation during boiling at regular intervals.
5. Keep contents of conical flask undisturbed for sometime at room temperature.

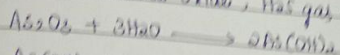
Teacher's Signature _____

6. Preparation of lyophobic solution - Arsenious sulphide [As_2S_3]

Aim: To prepare colloidal solution of lyophobic solution of arsenic sulphide solution.

Apparatus: Conical flask, 250ml, beaker 250ml, round bottom flask, 500ml, glass rod, funnel, glass tube, filter paper, wire gauge, given stand clamp.

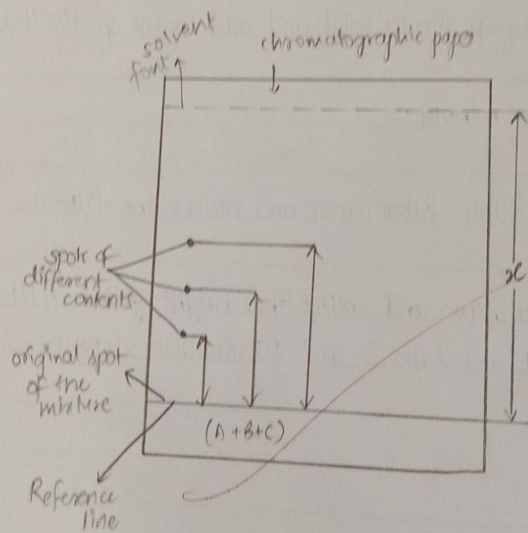
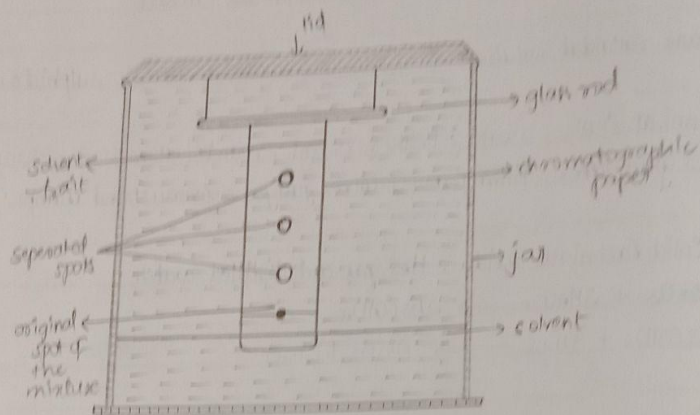
Chemicals: Solid Arsenious oxide, H_2S gas and distilled water.



Procedure:

1. Take a 250ml of conical flask and clean it by streaming out.
2. To this cleaned flask add 0.2g of As_2O_3 solid and add 100ml of distilled water.
3. Boil the solution for about 10 minutes.
4. Filter above hot solutions through filter paper and receive the filtrate in beaker.
5. Filtrate solution through filter paper and collect the bright yellow filtrate in a dry conical flask and cork it and label it as "ARSENIOUS SULPHIDE SOLUTION".

Teacher's Signature _____



Experiment - 1

Aim: To separate coloured components (pigments) from extract of leaves and flower by paper chromatography and determination of R_f values.

Apparatus: Gas jar, Glass rod, filter paper (Whatman No.1) strip, jar cover, fine capillary tube or syringe,

Chemicals required: Extract of leaves and flowers in a suitable solvent

Procedure:

1. Crush fresh flowers/leaves in a mortar and extract the juice with acetone.
2. Draw a reference line, about 4cm from one end of filter paper strip.
3. Put a drop of extract with the help of a fine capillary tube. Dry the spot in air.
Repeat 2-3 times putting every drop on the same.
4. Take 20cm³ solvent in a gas jar and suspend the filter paper with help of a glass rod in gas jar in such a way that the pencil line and spot remains about 2cm above solvent and spot lower end of paper dips in solvent.
5. Cover the jar with a lid and keep it undisturbed till the solvent rises 12-15cm above original line.
6. Take the filter paper out of jar and mark the solvent front with a pencil.
7. Dry the filter paper and put a mark with pencil in the centre of each coloured spot obtained.
8. Measure the distances travelled by solvent and each coloured spot from original line.
9. Record your observation as shown in table with using this formula.

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Expt. No. _____

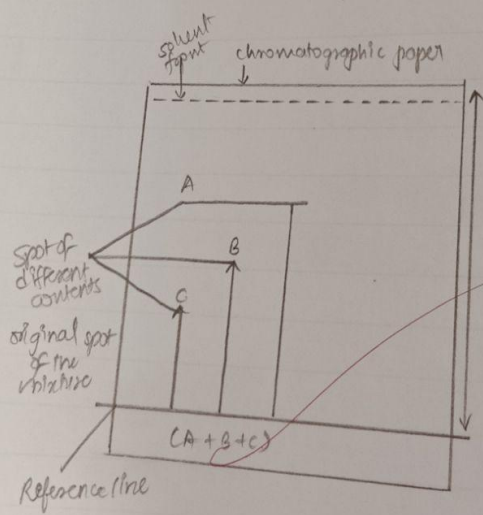
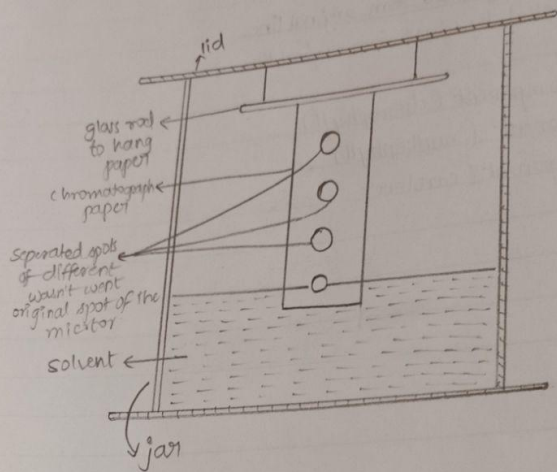
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Page No. 83

$$R_f = \frac{\text{Distance travelled by solute from original line}}{\text{Distance travelled by solvent from original line}}$$

Result: R_f of the green component (chlorophyll) ✓
 R_f of yellow component (xanthophyll) ✓
 R_f of the red component (carotene) ✓

Teacher's Signature _____



Experiment - 2

Aim: To separate Co^{2+} and Ni^{2+} ions present in the given mixture, by using ascending paper chromatography and determine their R_f value.

Apparatus: Gas jar, glass rod, filter paper strip [Whatman filter - 3], jar cover, fine capillary tube.

Chemicals required: Sample solution containing cobalt [II] and nickel [II] ions, acetone, concentrated aqueous ammonia, Rubeanic acid spray reagent.

Procedure:

1. Prepare the extract with the given mixture by using a mixture of acetone (90%), concentrated hydrochloric acid (5%) and water (5% as solvent).
2. Draw a reference line, about 4 cm from one end of filter paper strip.
3. Put a drop of extract with help of a fine capillary tube. Dry the spot in air. Repeat 2-3 times putting every drop on same spot.
4. Take 20 cm^3 solvent in a glass rod in the jar and suspend the filter paper with the help of glass rod in the gas jar in such a way that the pencil line and spot remains about 2 cm above solvent and the lower end of paper dips in the solvent.
5. Cover the jar with a lid and keep it undisturbed till the solvent rises 12-15 cm above the original line.
6. Take the filter paper out of jar and mark the solvent front with a pencil.
7. After elution and drying, place the paper in large, dry, covered beaker containing a smaller beaker of concentrated aqueous ammonia.
8. After about two minutes, remove the paper and spray it on both sides with rubeanic acid reagent.
9. Allow it to dry - Nickel becomes visible as blue purple band while cobalt becomes visible as yellow orange band.

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$$R_f = \frac{\text{Distance travelled by solute from original line}}{\text{Distance travelled by solvent from original line}}$$

Result: R_f value of $\text{Ni}^{+2} = \frac{A}{x}$

R_f value of $\text{Co}^{+2} = \frac{B}{x}$

Teacher's Signature

Qualitative Test for Carbohydrates: Glucose or Fructose:

Aim: To study some simple test of carbohydrates.

Chemicals required: Glucose, Fructose, Melisch Reagent, Benedict solution.

Procedure:

(i) Test with conc. H_2SO_4 :

Take a small quantity of carbohydrates in test tube and few drops of H_2SO_4 solution.

- (a) If the compound undergoes charring in cold condition is glucose is confirmed.
- (b) If the compound undergoes charring in hot condition is fructose is confirmed.

(ii) Melisch Test:

Few drops of alcoholic alpha naphthol solution is added to 2ml of aqueous solution of compound and then conc. H_2SO_4 is added by keeping the test formed between the function of layers.

(iii) Benedict's Tests:

To 1-2 ml aqueous solution of carbohydrate in a test tube and add 1-2 ml of Benedict reagent keep the test tube in a boiling water, both reddish ppt indicates the present of reducing sugar.

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Proteins

Qualitative test of Proteins:

Aim: To study qualitative Test of proteins.

Chemicals required: Proteins compound, gelatin dispersion, NaOH , CuSO_4 , HNO_3 ,
Ninhydrin reagent

Procedure:

(i) Burette Test:

To the dispersion of solution to be tested and add about 20ml of NaOH solution.
Now add 4-5 drops of CuSO_4 solution, warm the mixture for about 5 mins. bluish
violet colouration indicates the presence of proteins.

(ii) Xantho proteic Test:

Take about 2ml of substance to be tested and add few drops of conc. HNO_3 solution
and boil the contents a yellow ppt. is formed which indicates the presence of proteins.

(iii) Ninhydrin Test:

Take about 2ml of substance albumin dispersion in a test tube and add
3-4 ml drops of Ninhydrin solution and boil the contents.

→ Intense blue colouration confirms the presence of proteins.

Verified by
N. Sri Ranga
24/02